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EXPERIENCES IN CEREBRAL SURGERY.*

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THE most frequent causes of death following operations for tumor of the brain are shock and sepsis. "Shock is responsible for 8 per cent. of the deaths in the tumors correctly and accurately diagnosed and successfully removed. Whereas, in operations in which the tumors are inaccurately diagnosed, not found, and not removed, shock is responsible for 37 per cent. of the deaths" (Horsley, *British Med. Journal,* Aug. 23, 1906). In an approximative way this shows the importance of shock in operations upon the brain. Sepsis, like shock, is an important cause of death, but more especially as a secondary infection. Primary infection—that is, an infection at the time of operation—is rare, but it is the experience of most surgeons that just in proportion as one must drain and the healing is to be by granulation tissue, the danger of infection will increase.

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Nothing is more striking than the security against infection given by a primary union, and the absolute uncertainty existing in cases drained. To overcome these important factors we try to shorten the time of operation, to limit the hæmorrhage, and to avoid drainage in any form.

During some years of an operative experience in cerebral surgery we have noticed that many operations are performed with instruments often imperfect in themselves, or in the use of which the surgeon is frequently not familiar. We have also observed that after the definite localization of a tumor or cyst the craniocerebral topography is so imperfectly applied, and the flap so badly fashioned, that the tumor or the disease, if not extensive or prominent, is not found until autopsy reveals it. It has been our aim to shorten the time for operation by overcoming these undesirable facts. We have therefore tried, first, to find an armamentarium upon which we could thoroughly rely, which would serve as well no matter how thick or thin the skull, and which would permit an exposure of the dura in the shortest possible time and with the best possible relation of the bone and the flap to the skull after replacement. We have used in a number of instances the trephine, and from its opening have cut away the bone with the rongeur or have cut out a bone flap with some specially devised bone forceps, chisel or fraise. We have always been cognizant of the objections to their use, namely, the imperfect application of the bone flap to the skull when replaced, permitting the bone to rest upon the dura rather than upon the surrounding bone.

Second, when chisels are used the repeated blows have, in thick skulls, been productive of considerable shock. These objections are avoided by the Gigli saw, which cuts from within outwards, and with a very narrow slit, so that when the bone is replaced, if the bevel is ever so slight, it will rest upon the surrounding bone and not upon the dura. Its application requires several trephine holes, and the passage of a guard or director from hole to hole. When the dura is tightly attached to the bone or the intracranial pressure is great this is a tedious process. Unless the saws are of the best quality

they not infrequently break at the most inopportune moment. We have used also the Van Arsdale saw, a circular saw shaped like a saucer, and intended to cut on a curve, the dura being protected by a guard which follows in the slot, having been introduced through a trephine opening. The objection we have found to this saw was that the guard and the saw were very apt to jam and stick unless the particular arc for which the saw was designed was accurately followed. We have used also the Stellwagen trephine, a trephine having cutting teeth mounted on a movable arm which can be adjusted at any distance from the central fixed point. Larger or smaller osteoplastic flaps can thus be cut. The objection we have to this is that which we entertain against all trephines, including the large Horsley trephines, namely, that they do not cut the skull accurately and rapidly, nor allow of variation enough in their size to be of practical value in osteoplastic flaps.

We have used also Powell's saw in combination with the trephine. This has been quite satisfactory. The cutting depth is regulated by an adjustable shoe controlled by a screw. The screw, however, is apt to become loose and thus change the depth at which the saw will cut. We have used in the same way the Marsland saw, but see in it no advantage over other saws. The mechanism of the guard and the handle is good.

We have also used the Sudeck saw, but we consider it unsatisfactory, as it has no guard to regulate its depth in cutting nor are the handles so placed as to render it easily manipulated where a thick scalp is present.

We have used in addition the Doyen circular saw, and the method of using it has appealed to us more than any other saw. The mechanism is simple, and the individual parts are strong and do not get out of order.

From 1900 up to about a year ago many of the operations on the skull have been performed by us with the aid of burrs, drills, and circular saws, the power being furnished by a quarter horse-power motor through a flexible shaft which was made up of links, and was considerably heavier, stronger and more flexible, with less vibration and jar, than those made

of twisted wire. The entire shaft was sterilized by being disconnected from the motor, wrapped with a gauze bandage, and put in a bag or towel. The disadvantage of this apparatus was that, owing to its weight, it was not easily transported. The shaft, though flexible, had a certain fixed length which oftentimes, seriously interfered with the free manipulation of the cutting tool, and when bent at a slight angle, owing to the increased friction, gave a peculiar jar and vibration to the cutting tool. To overcome some of these objections, we make use of the following implements: *First,* a small motor, of such size and weight that it can be held by the operator himself, giving him perfect control of the cutting tool and also of the power (Plates I and II). The tools are connected by means of an appropriate chuck directly to the end of the armature, thus obviating all loss of power which occurs when a flexible shaft is used (Plate V, Figs. 1, 2, 6, 12).

To provide for the proper sterilization of the apparatus, a thin metal casing in three pieces is accurately and securely fastened to the motor, completely enclosing it, yet readily removable. This casing, with about 10 feet of ordinary flexible electric light wire is removed from the motor and boiled. The interior is dried with sterile gauze and then replaced on the motor, thus making a perfectly aseptic exterior. The method by which the sterile casing is applied to the motor is as follows. The motor is held with a sterile towel in the palm of the left hand, the end *A* being up. (See Plate II.) The portion *B* is now screwed down as far as possible and grasped by the right hand, which holds the motor, while the left hand being free, drops the towel, picks up the other portion *C* (which is still sterile inside and out) and slips it in place where it is securely held by screwing down the knob *D*.

During the operation the motor is held as follows: The adjustable handle *E,* placed at right angle to the long axis of the motor, furnishes a firm convenient grasp for the right hand. The knob *D* is grasped with the left hand. The left thumb or left index finger may be used to manipulate the switch which makes and breaks the current. Occasions may

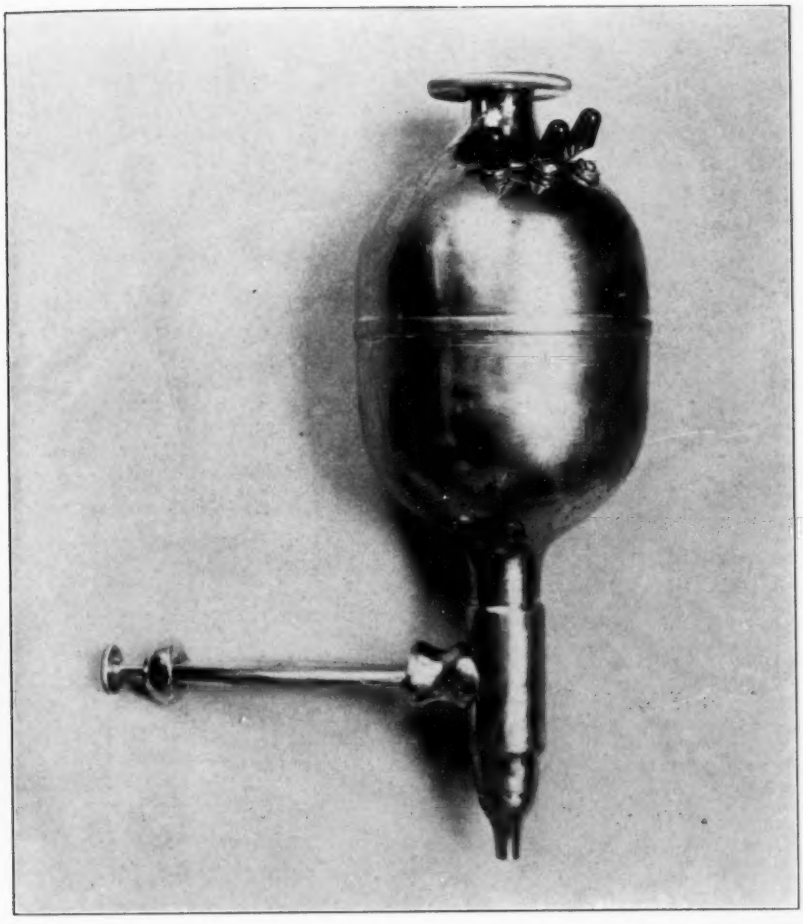

PLATE I.—Motor and casing complete. Weight, 8½ pounds. One-eighth horse-power.

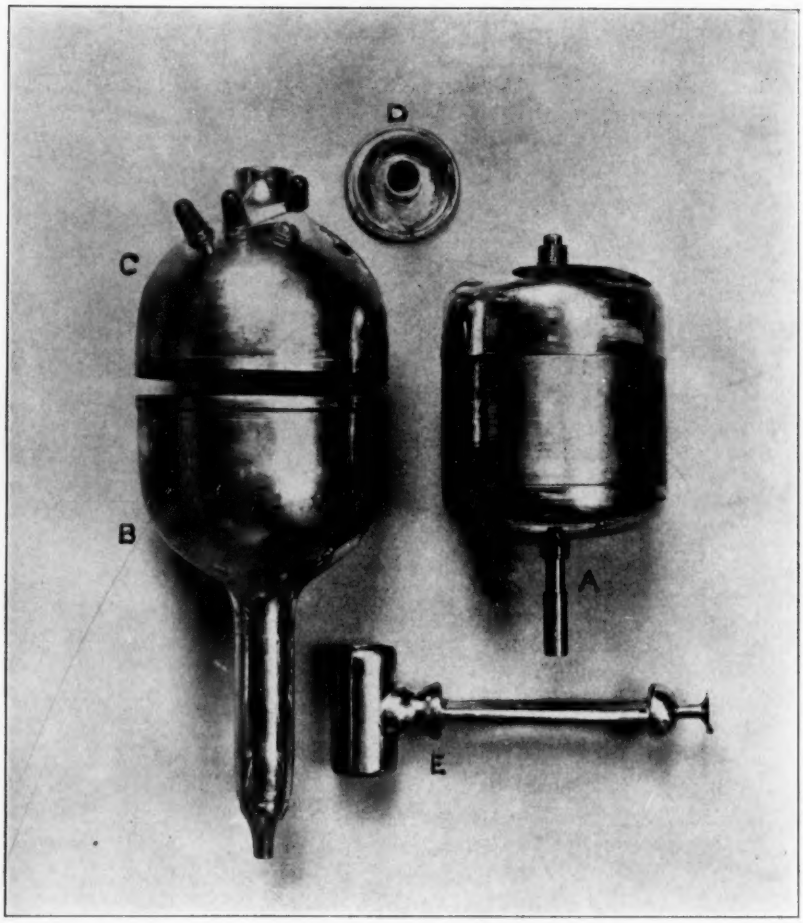

PLATE II.—Weight, with casing complete, 8½ pounds. Weight, without casing, 6¼ pounds. Length, 10½ inches. Diameter, 4⅛ inches. Circumference, 14¼ inches. Speed, 2100 revolutions per minute. Volts, 115. A direct current; shunt wound. About ⅛ horse-power.

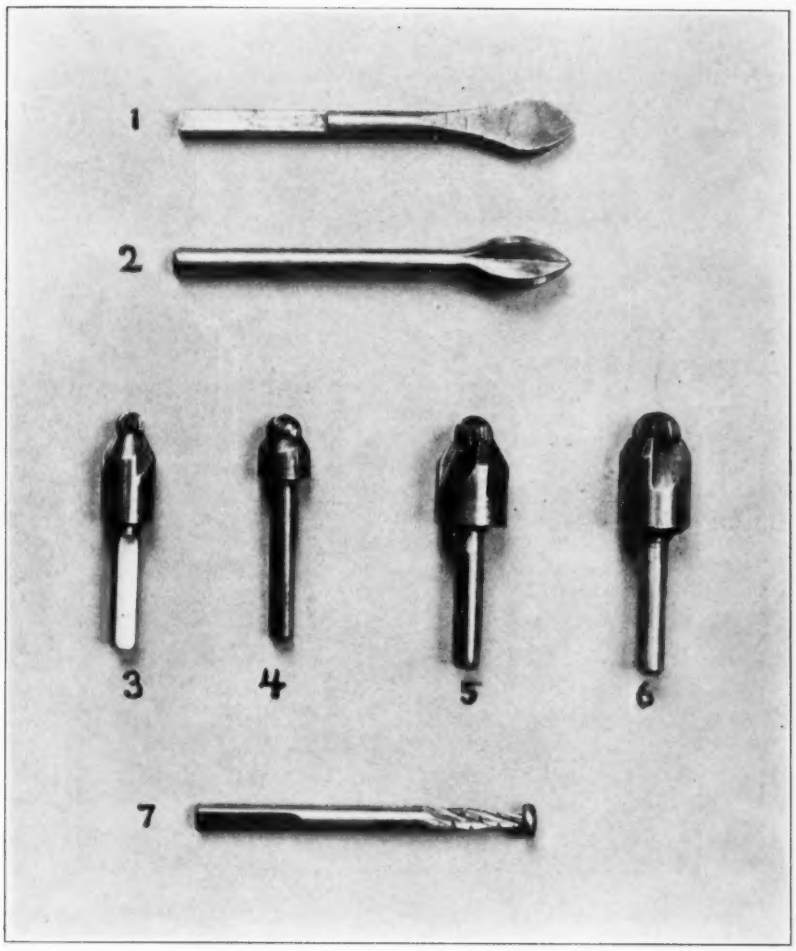

PLATE III.—1, 2, Conical cutters. 3, 4, 5, 6, Ball mounted in tip of cone. 7, Fraise. 1 followed by 3 is the usual combination.

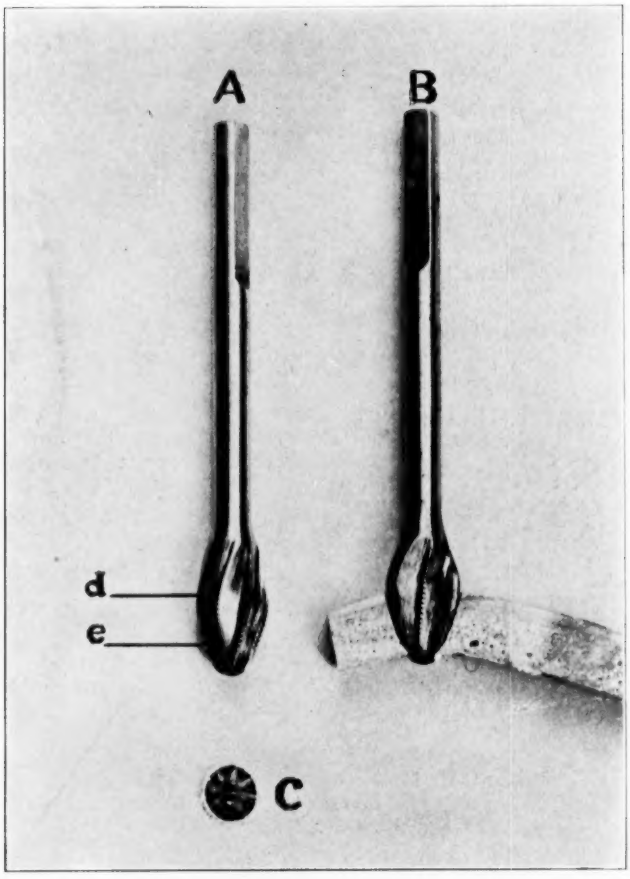

PLATE IV.—A single cutter combining the functions of 1 and 3, Plate III. *A*, *d*, greatest diameter of cutter, 10 mm. Distance from *d* to tip, 11 mm. Blades between *d* and *e* are serrated to facilitate cutting. Distance from *e* to tip 4 mm. *B*, manner in which cutter enters skull. *C*, end view of cutter.

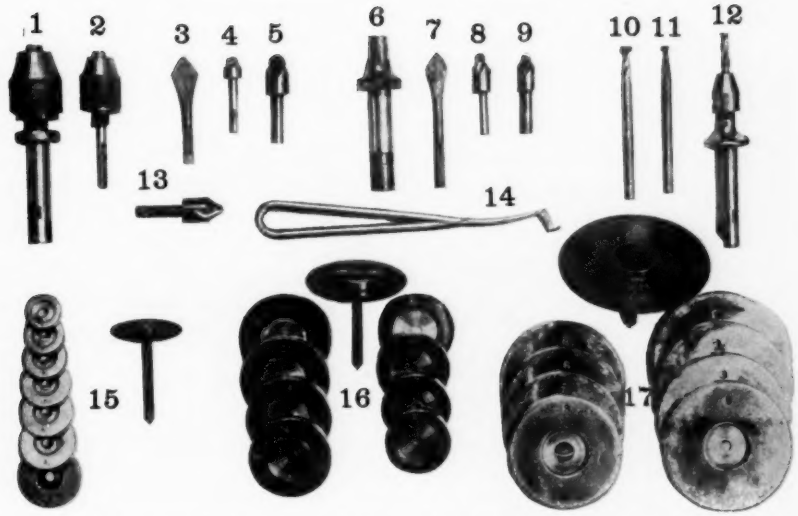

PLATE V.—1, 2, 6. Chucks. 3, 7, Conical cutters. 4, 5, 8, 9 Ball and cone cutters. 10, 11, 12, Fraises. 14. Measure. 15, 16, 17, Circular saws with guards.

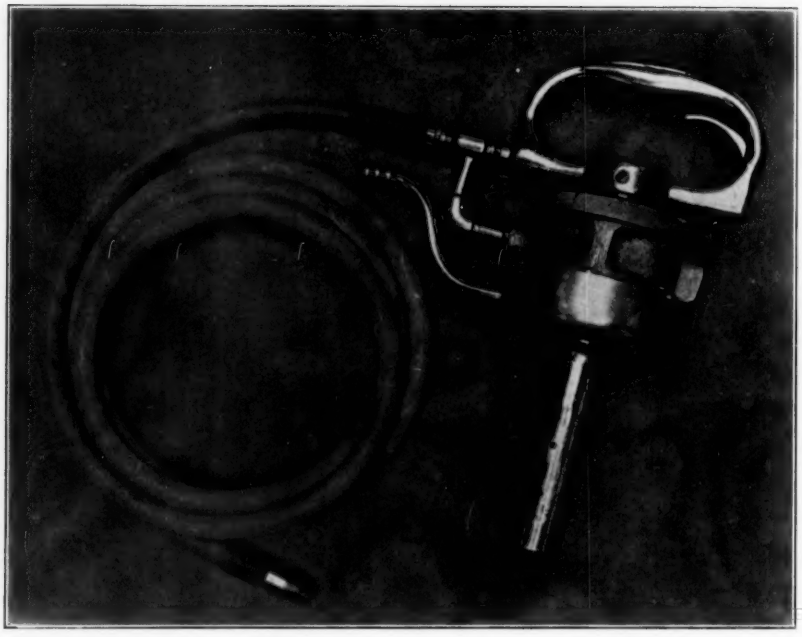

PLATE VI.—Compressed-air motor fitted for using the same cutting tools as the electric motor. Weight, about six pounds. Requires 80 to 90 pounds air pressure. Motor and hose can be boiled.

arise when the position of the hands holding the motor will have to be reversed, but this can be easily done, and with the same degree of certainty of action in the instrument.

Secondly, a cutter has been devised after considerable experiment with all forms of drills and burrs which we could find. The shape of the cutter permits one to enter the cranial cavity without fear of suddenly pushing through the vitreous plate. The serrations upon the blades between *d* and *e* (Plate IV, Figures *A* and *B*) allow one to appreciate with the less rapidly cutting end, as with a probe, the difference in density of the outer plate, the diploe and the inner plate of the bone. One can appreciate this even by watching another person using the instrument.

Formerly we made use of two instruments instead of this single cutter,—the one a drill, the other a burr set in the end of a cone, which latter allowed the reaming of the cavity and at the same time prevented the burr from suddenly passing through and injuring the dura. We have of late been able to combine these two instruments in one, and feel that thereby we have shortened measurably the time in entering the the skull. This instrument is shown in Plate IV and the two separate instruments as devised by us and used formerly to a large extent are shown in Plate III, Figs. 1, 2, 3, 4, 5, 6, and Plate V, Figs. 3, 4, 5, 7, 8, 9, 13.

Thirdly, a circular saw. Upon this saw we make use of Doyen guards, each being stamped with the number of millemetres it will permit the saw to cut. We prefer this guard to others because it is strong; it is simple and it is easily sterilized. The saws vary in size from 1 to 3 inches in diameter; the larger saws being used when the tissues of the scalp are thick, and the narrower ones when the tissues of the scalp are thinner (Plate V, Figs. 15, 16, 17).

The other instruments which we make use of are those that are commonly used in all osteoplastic operations upon the skull, such as the retractors, the spud-like instruments for the elevation of the bone flap, the narrow, slender osteotome, periosteum elevator, and a millimetre measure for the depth

of the skull (Plate V, Fig. 14). Where an accurately fitting bone flap is not required or where the bone is to be removed completely and not replaced or where an opening in the skull is to be enlarged, a fraise may be used (Sudeck's, Cryer's, or Sykes'). If no opening exists, a hole is drilled of sufficient size to admit the button on the fraise. The fraise is inserted and forced to cut in the direction desired. We have modified the ordinary fraise by having cutting teeth or serrations upon the blades, and it seems to improve its efficiency to a marked extent. We object to the use of the fraise, however, except under the conditions above mentioned, because it cuts a wide slot which prevents an accurate fitting of the bone after its replacement. It cuts slowly, with considerable heating, especially where the bone is over 6 millimetres in thickness. (See Plate III, Fig. 7, and Plate V, Figs. 10, 11, 12.)

We have used in a few instances a motor run by compressed air, the same chuck and tools being used in the motor with compressed air as we have used in the electric motor. This whole apparatus, with the tubing, can be boiled. The motive power must be compressed air, at a pressure of 75 to 90 pounds, in order to have it efficient.

In the second place, we must determine upon a method of cranio-cerebral topography which is thoroughly reliable and practical. Contrary to the opinion expressed by many surgeons, I believe that cranio-cerebral topography deserves an extensive application in the surgery of the brain. The Chipault method, which I have used for eleven years and have tested upon over 200 cadavers, and in some 40 operations upon the living, is the most comprehensive and generally correct of all the systems. It adapts itself to all varieties of skull, no matter whether they be the result of race, age or individual peculiarity. The constant use of this system renders one quite adept in locating to a nicety the sulci and convolutions, and the various sinuses, without measurements; but this is not to be expected in everyone, and some trustworthy system must be at hand. (Chipault's "Chirurgie Opératoire du Système Nerveux," p. 121, vol. i.)

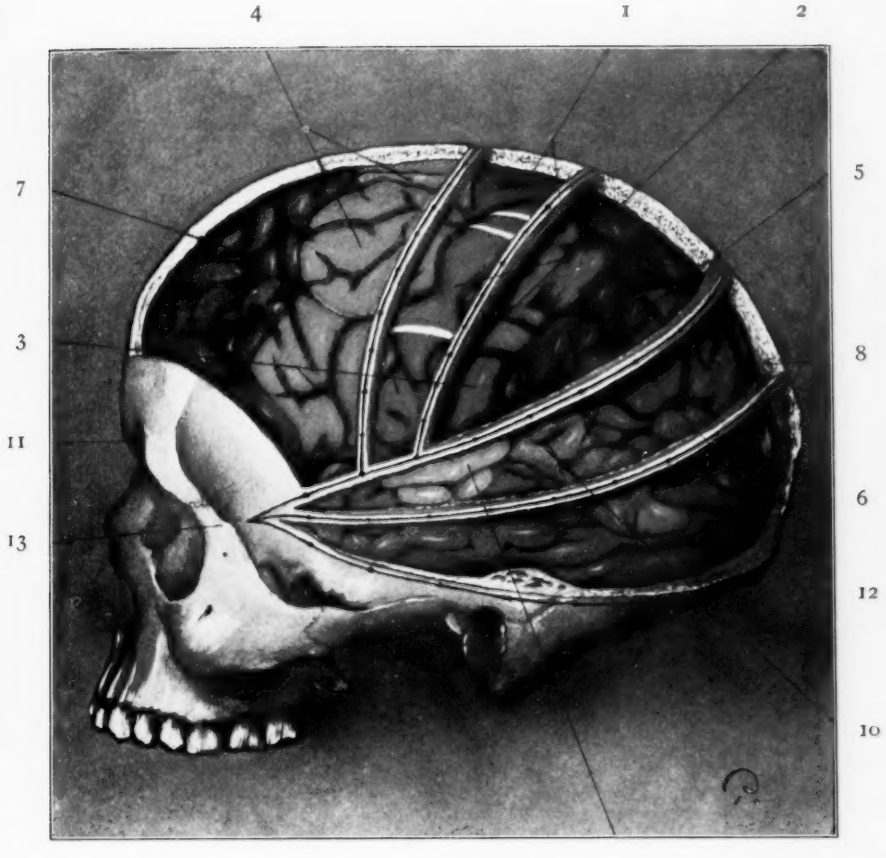

PLATE VII.—1. Motor and sensory disturbances, lower extremities. 2. Motor and sensory disturbances, upper extremities. 3. Motor and sensory disturbances, face, tongue, jaw, pharynx, vocal cords. Motor aphasia in right-handed people and vice versa. 4. I. Movements of the body (posterior part of the first frontal convolution). II. Movements of the head and neck (posterior part of second frontal convolution). III. Associated movements of the eyes and head. 5. Tactile and muscular sensibility. 6. Hemianopsia and word-blindness, agraphia and paraphasia. 7. Intelligence. 8. Storage of visual images (cuneus, lingual lobe and calcerine fissure cannot be seen). 9. Audition. 10. Images for words heard and musical tones (left side). In this same region on both sides, the sensory motor auditory centre exists. 11. Nasion. 12. Inion. 13. Retro-orbital tubercle.

The internal frontal convolution lies in the longitudinal fissure, opposite the superior frontal convolution. The para central convolution lies in the longitudinal fissure opposite the ascending frontal, between the 45% and 55% points. The quadrate lobe lies in the longitudinal fissure opposite the ascending and inferior parietal convolutions, between the Rolandic and Sylvian lines, that is, the 55% and 70% points. The cuneus, lingual and the fusiform lobes, first, second and third occipital convolutions are between the 70% and 95% lines.

Plate VII is made from a specimen most carefully prepared by Drs. Ayer and Spitzka. The subject used was injected immediately after death with a strong solution of formalin under slight pressure. The Chipault measurements were then made upon the skull and the bone between the lines was removed, leaving the thin and narrow strips of bone to represent these lines. The skull was now bisected anteroposteriorly and the hardened brain was removed entire. From this brain a cast has been carefully prepared, and upon this cast has been painted the various points of localization as we use them. The cast has been substituted for the brain in the skull, and this drawing has been made from it. One can see from this drawing that, given any point of localization of value, a sufficiently large flap can be made which will have beneath its centre, or to one side of its centre if desired, the area in the brain to be exposed. Flaps accurately placed are of great advantage because one removal of bone is sufficient for the exposure of all possible eventualities. For the neurologist and for the surgeon such a flap permits a rapid and accurate orientation of the area to which the motor, sensory or sensorial symptoms have referred. For the patient it shortens the time of operation, it diminishes the hæmorrhage, and it avoids undue shock.

The great advantage of an accurate knowledge derived from this source can only be appreciated when searching for subcortical tumors or in dissecting out traumatic cysts with their irregular diverticula and their adhesions to the surrounding brain tissues.

It is our custom, therefore, to measure every scalp before it is cleaned for operation. The measurements are written down and at the time of the operation the lines are drawn with a fuchsin pencil or with tincture of iodine. After consultation with the neurologist the possibilities of the case are considered, and the flap is fashioned so as to best expose the area desired. After the bone flap is thus fashioned and the dural flap is made, the lines will show at a glance the fissures and convolutions desired. At any time the flap may be replaced,

and the position of the line upon the brain measured with the eye. If the disease or tumor can be located, the centre of the flap is usually over the point of localization. If the localization cannot be exactly determined, the operation becomes more or less exploratory, and the flap is cut so as to expose centre of the parietal or both sides of occipital or frontal or cerebellar lobes.

Thirdly, we are convinced, after quite an experience in cutting cranial bone flaps, that the best form of flap is one which obtains its blood supply from the temporal or occipital arteries. The supra-orbital and frontal arteries may be used, but they are not necessary.

Fourthly, the variations in the depth and density of the bones of the skull have shown us that the safest and quickest means of dividing the bones is to select the thinner portions as bases for the periosteo-osseous flaps, and to divide the thicker and denser portions with a saw. The variations in depth of the bones range between 1 mm. and 12 mm. in the adult. We have measured one or two skulls in which the temporal fossa has measured ½ mm. in depth. Some skulls have measured 12 mm. to 12½ mm. in the thickest portions, near the sagittal suture or in the occipital bone. We expect usually to find in the temporal fossa the thickness ranging from 2 mm. to 5 mm. Half way between the temporal fossa and the sagittal suture the usual variation in depth has been 5 mm. to 7 or 8 mm., while from this point to the median line the depth usually ranges from 7 or 8 mm. to 11 or 12 mm. This variation in measurements holds good for all parts of the skull from the frontal bosses to the superior curved line of the occipital bone. So that, if a line be drawn 1 cm. laterally to the sagittal suture from the frontal bosses to the superior curved line of the occipital bone, the varying depth will be from 7 to 11 mm. If a line be drawn half way between this line and the ridge bounding the temporal fossa from the frontal bosses to the superior curved line of the occipital bone, the usual depth of the skull will range between 4 or 5 and 6 and 8 mm. In the temporal fossa itself the variations will be from 1 to 4 or 5 mm.

From these measurements one can conclude that the thinnest part of the skull is in the temporal fossa, and that from the edge of this fossa the bone increases in thickness and density as it approaches the frontal bosses, the sagittal suture and the superior curved line of the occipital bone. Unfortunately, this increase in thickness and density is not always regular nor gradual, so that in the preparation for the saw one must drill enough holes to avoid a decided variation in depth. We have found that if the drill holes are within 4 cm. of one another one is reasonably certain of avoiding any great disparity. If such is observed, a third hole may be drilled between the two holes showing such disparity. The danger arising from this disparity in depth can be eliminated in this manner. Because the temporal fossa is thinner than the remainder of the convexity of the skull, all our bone flaps exposing the frontal, the parietal and the occipital regions of the brain are best and most easily made when the base of the flap is in the temporal fossa. This being the thinnest part of the skull, the breaking of the bone can be accurately determined and made without the great force necessary to break it in a thicker portion, and the uncertainty which exists of having the bone flap break in the middle and not at the desired point. This may occur, no matter how much care is used when a very thick bone is used for the base of the flap. All our flaps then radiate from the temporal fossa as a base. Frontal flaps have their bases in the anterior part of this fossa, parietal flaps in the middle of this fossa, and occipital flaps in the posterior part of this fossa.

Fifthly, after a flap is fashioned and the bone is removed, it may be replaced. The defect may be filled with bone from another individual, animal, or with a foreign substance. We prefer, in all cases, to replace the bone or to implant a foreign substance because this affords protection to the brain, it prevents hernia cerebri, it limits adhesions between the dura mater and the pia mater and the brain, and it secures the most rapid and perfect healing.

Of these methods, we prefer the autoplastic to the homo-,

hetero- or necro-plastic; we prefer the necro-plastic to the homo- or hetero-plastic.

Autoplasty is performed by the implantation of bone having a partial connection with the surrounding parts (Wolff: *Langenbeck's Archives,* No. 4, p. 183, 1863; Wagner: *Centralblatt fur Chirurgie,* No. 47, 1889) or by the implantation of bone completely separated from all connection with the surrounding parts (von Walther: *Langenbeck's Archives,* No. 4, p. 196).

The former method is preferred: First, because bone which is entirely separated from the periosteum and implanted usually undergoes absorption and a gradual substitution by new bone, and this substitution does not always take the shape and form of the displaced bone. Second, because such implanted bone larger than 8 cm. x 5 cm. has, as a rule, undergone necrosis. Third, because bone which remains in connection with the periosteum and implanted undergoes an immediate reparation wherever the circulation has been in no wise disturbed. This condition is best obtained where the continuity of the bone has been the least disturbed, and subsequent apposition of the bone flap and skull is the most intimate. (Stieda: *Archiv. fur klin. Chir.,* No. 77; Biagi: *Deutsche Zeitschrift fur Chir.,* No. 65.)

The most successful autoplastic result therefore occurs when the bone edges are cleanly cut, are cut with a very narrow slit, and are slightly bevelled. This will bring the replaced bone in perfect apposition with the surrounding skull and dura, and will avoid any pressure upon the brain by reason of the bevelled edges.

Sixthly, For the general result hæmorrhage is a most important element. It should be quickly controlled in order that time may be saved.

Our method of operating is as follows:

A preparatory treatment of one week, if possible, is desired. During this period drugs are given up as far as possible, the bowels are regulated, and the skin and kidneys are put in good condition. If it is possible, a sphygmographic

record of the pulse rate and blood pressure is made during this time. The head is completely shaven, and the measurements for the Chipault cranio-cerebral topography are made and recorded. The skin is then prepared for operation in the usual way. Chloroform is the anæsthetic preferred. The position of the patient upon the table is important. We prefer to have the body inclined at an angle of from 10 to 30°, with the head upward and beyond the end of the table, resting in our special head-support, which permits of a further change of the head without difficulty. At the side of the table an assistant applies to the wrist some form of blood-pressure apparatus, and records during the operation the pulse rate and the degree of blood pressure. The operator and the anæsthetist can, by watching the needle, record the blood pressure, and best inform themselves of an impending shock. The operator can decide in this manner the necessity of a two-stage operation. He can thus avoid some of the 25 per cent. of sudden deaths which follow operations upon the brain. (*American Journal of Medical Sciences,* 1904, p. 320.)

A tourniquet is applied surrounding the head, just above the ears. This may consist of an inflatable rubber tubing or be a simple rubber tubing tied or held by a fastening. If the tourniquet is not used, a large number of compression forceps are at hand and, as each limb of the incision is cut, an assistant compresses this side until the vessels are clamped and tied. Instead of ligatures a buttonhole stitch may be applied over the cut edges of the skin, aponeurosis, muscle and peritoneum. If one desires, the clamps applied to the vessels may be left without tying until the conclusion of the operation. A recent important addition to this subject has been the application of Kredel's steel plates (*Centralblatt fur Chirurgie,* No. 43, 1906). So far we have not had an opportunity to make use of them, but they appeal to us as very simple and practical. Our incisions expose a ▽ shaped flap. Each limb or third of the incision is made with a single stroke of the knife to the bone, in order that the vessels be readily exposed for ligation. A hoe-shaped periosteum elevator is now used and the perios-

teum is raised beneath the flap for a distance of 1 cm. upon all sides. The periosteum surrounding the flap is also pushed back for 2 cm. This gives, when the retraction is complete, a broad area for the cutter and saw. By raising the periosteum beneath the flap for 1 cm. and applying the cutter and saw near the reflected margin of the periosteum an excess of periosteo-musculo-cutaneous flap is obtained, and the subsequent suture line of the flaps does not coincide with the incision in the bone. (Curtis.) Our retractors are now inserted and the field is prepared for the cutter. This is applied to the bone at each corner of the flap, and the dura is exposed. The depth of the several holes is ascertained by the measure. Whenever the disparity between two holes is over 2 mm., that is, 3 or 4 mm., it is best to interpose one or more holes, and ascertain whether it is an abrupt or gradual incline. In this manner one can tell whether he should saw straight through, should bevel or should change the guard upon the saw. This makes the procedure safe, and it does not delay the operation to any extent. As the depth of the holes varies, it is our practice to saw the deeper parts at first with a saw guarded for 2 mm. less than the depth. This saw passes straight through between holes having the same depth. When the holes having a smaller depth are approached, one must either change the guard or diminish the depth by bevelling. If such disparity exists between two holes, we saw at first straight through and then gradually incline the saw so that a ledge is left upon the skull which supports the bone flap. We find that to slant the saw sufficiently to eliminate a difference of 2 mm. in depth is about all that we can do nicely and with certainty. When greater disparity in depth exists, the angle formed by the saw and the skull will be 45°, and this is not very easily maintained. A disparity of 1 to 2 mm., however, is overcome by slanting the saw from 10° to 30°, which can be done with accuracy and ease. If one prefers, one can change the guards more frequently, but it is scarcely necessary except for marked irregularities, for depressions from Pacchionian bodies or when passing over sinuses. In some parts of the skull, as the

temporal fossa near the zygoma or the cerebellar fossa, where the muscular tissue is very thick, or wherever we intend to sacrifice bone, we may substitute for the saw our toothed fraise which, though it cuts a rather broad slit, nevertheless answers the purpose admirably.

An osteotome is now inserted in the slit, and a few strokes of the hammer, unless the bone is very thick and has been imperfectly sawn, will crack the vitreous plate. The plate is now raised and broken at its base with a spud-like instrument. The base will break evenly across provided the two holes at each extremity of the bone have clearly divided the internal table. I have never seen the slightest injury result when the holes have perforated the internal table, provided the base is less than one-half of the greatest width of the flap and is not thicker than 4 mm. At this time hæmorrhage from the bone will require some attention. We use for this purpose either a crushing forceps upon the bleeding sinus in the bone, or plug it with decalcified bone, cut in the shape of a match, or with Horsley's wax. The flap, including the bone, periosteum, muscle and skin having been reflected and wrapped in a sterile towel to protect it from injury or infection, the dura is exposed and its pulsation or want of pulsation is noted. If wanting, we suspect the cause to be either adhesions between the dura and the arachnoid, exudates, pus or blood between the membranes, severe contusion of the brain or tumors near the cortex producing anæmia of the overlying brain.

We must determine, if possible, which of these conditions is probable, and then proceed to the formation of our dural flap. This flap we usually incise along three margins of the bone, leaving enough for a subsequent suture when the dural flap is replaced. Usually the uncut side is the one which has the larger vessels. With the retraction of this flap the brain is exposed. At this time, the pressure being relieved, there may be a marked fall of blood pressure, as shown by the sphygmographic tracing. If this is the case, the operation may be postponed, after replacing the bone flap, for two to seven days, or until a time when the circulatory equilibrium is restored.

If we are to proceed with the operation, the procedures for the removal of the disease or the tumor will vary necessarily according to the kind and extent of the pathological process. (See individual cases.) After the disease or the tumor is found and removed, hæmorrhage is carefully checked. And we find it best in all cases to tie the arteries with catgut, to use hot water at 115° or gauze held in contact with the bleeding surface, when the hæmorrhage is capillary. When it is venous we apply sutures where the sinuses are involved, and where it is simply a venous oozing we reduce the chloroform and administer oxygen, as suggested by Horsley (loc. cit.). We have also found that the application of Cargile membrane to the raw surface of the brain tends to check the slight oozing remaining after the larger vessels have ceased bleeding. The hæmorrhage being carefully controlled, the dura is sutured and the bone is replaced. The drill holes, where the operation is an aseptic one, are sufficient for drainage, but when this is not the case, or drainage must be extensive, these openings may be enlarged by cutting away the bone opposite the bone flap. The bone flap when replaced fits accurately and cannot be driven in even when forcibly pressed upon. The periosteum and muscle are sutured by a single suture. Our drainage when used is the cigarette drain. The skin is sutured over them, and an aseptic dressing is applied. The head is fixed and is held slightly elevated above the level of the body.

This is our technique in autoplastic operations upon the skull, and we employ it in every instance. Our flaps must be so planned as to expose the several lobes of the cerebrum as well as of the cerebellum, on one or both sides, and consequently we will so describe them.

Frontal Lobes.—Disease or tumor involving the frontal lobes, as well as tumors of the hypophysis, demand an exposure of both sides at once, unless the symptoms point distinctly to one side. The exposure should be sufficient in all instances to give access to the upper, lower and lateral surfaces of the lobe in any case, no matter whether one or both sides are to be exposed. Again, if motor symptoms are combined with

symptoms of purely frontal involvement, the exposure must include the ascending frontal and possibly the ascending parietal convolutions. If the symptoms localize the disease to one side, the incision necessary to expose the three frontal convolutions upon their anterior and lateral aspects must include the area bounded by the depression between the frontal bosses and the superciliary ridge, the prærolandic line and the median line. The base of this flap and the line of breakage in the bone we make in the temporal fossa above the zygoma, where the bone is the thinnest. Our incision commences one finger's breadth from the median line, usually midway between the glabella and the superciliary ridge. It passes outward parallel to this ridge until the temporal ridge is met, where it descends towards the zygoma, ending just above it. The second incision passes from the commencement of the first, parallel to the interfrontal and sagittal sutures, as far as the prærolandic or Rolandic line, depending on the extent of the localizing motor symptoms. The third incision passes from the termination of the second toward the external meatus, ending just above the lobe of the ear. The flap is larger or smaller, depending upon the extent of the motor symptoms combined with the psychical.

This, to be sure, brings an incision directly across the forehead above the orbit, but I believe it is better to have this scar than to attempt to avoid the scar and risk breaking into the frontal sinuses, thus complicating the wound treatment. If one wishes to avoid the scar the line of breakage may be made at the upper level of the frontal sinuses. In this case, the supra-orbital and frontal arteries will supply the flap. We prefer, however, to have the line of breakage in the thin squamous portion of the temporal bone, and to have our arterial supply from the temporal arteries. After these incisions are made to the bone, the hæmorrhage is controlled Retractors are inserted at the angles of the wound, and the cutters are used. One hole is made at each extremity of the second incision, one at the temporal ridge, one at each extremity of the first and third incisions where the line of breakage

is to take place. We usually content ourselves with these five openings unless the distance between them is greater than 3 to 4 cm., or the disparity in the depth of the skull is more than 3 or 4 cm. In the latter case we prefer to drill one or more holes to ascertain the depth and to know where to saw straight through, and where to bevel or to use a smaller saw. As soon as the sawing is completed the bone flap is raised and broken in the squamous portion of the temporal bone. There are usually one or two veins from the longitudinal sinuses and the sphenoparietal sinus which bleed, but these can be easily and quickly secured as soon as the bone flap is raised. In some instances the frontal sinus is opened, but one can be reasonably sure of avoiding it by making the incision nearer the glabella than the superciliary ridge. Sometimes when the bony wall of the sinus is exposed its muco-periosteal lining remains intact. Even if it be opened, it can be drained and packed by cutting away a part of the anterior wall. (Duret: "Les Tumeurs de l'Encéphale.")

During the formation of the periosteo-osseous flap, the time consumed and the failure to stop hæmorrhage may result in a marked diminution of the blood pressure, and presage an impending collapse. To avoid such a result, the operation should be terminated, the wound packed, and the patient placed in bed and treated symptomatically. Within seven to fourteen days the operation is resumed and completed. When resumed, the bone flap is reflected, and palpation of the dura mater determines the degree of intracranial pressure, as well as the difference in the consistency of the underlying tissues. This can be rendered more appreciable by raising the patient's head and diminishing the intracranial blood pressure and tension in the dura, as suggested by von Bergmann. Observation again gives the changes in the color and often the location of the diseased area from the want of pulsation in the dura. The dural flap is now incised upon three sides of the quadrilateral area exposed by the bone flap, selecting for the base of this flap the most vascular part. If the frontal sinus has been opened, we make the base of this dural flap at this side

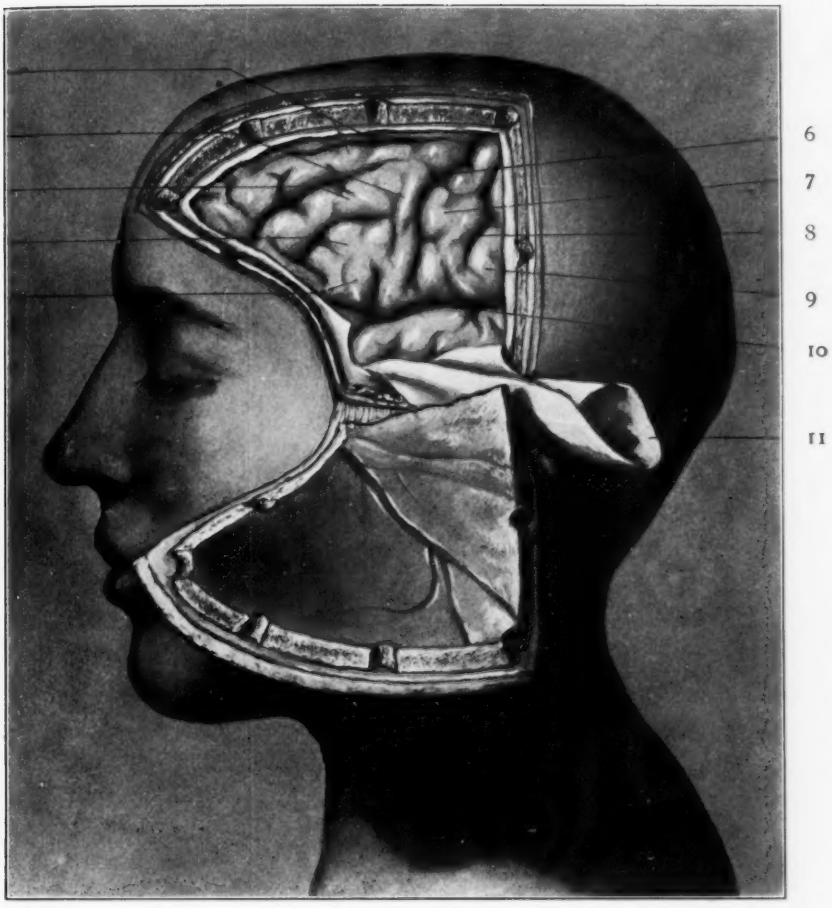

PLATE VIII.—1. Superior frontal convolution. 2, 3. Middle frontal convolution. 4. Inferior frontal convolution. 5. Points to vertical limb of the Sylvian fissure. 6. Points to the præcentral sulcus. 7. Points to the ascending frontal convolution. 8. The fissure of Rolando. 9. The ascending parietal convolution. 10. Fissure of Sylvius (the first temporo-sphenoidal convolution is shown just below the fissure). 11. The dural flap.

of the quadrilateral space. This flap exposes the three frontal convolutions, superiorly and laterally. It exposes in front the ascending frontal convolution, the Rolandic operculum, the Sylvian fissure, and the first temporo-sphenoidal convolution as far as the parietal operculum. If the incision is made just behind and parallel to the præcentral sulcus instead of just behind and parallel to the Rolandic, then the Rolandic operculum and the fissure of Rolando mark the posterior boundary of the exposed area. By retracting outward the internal surface of the frontal lobe may be seen. By raising the frontal lobe the inferior surface may be palpated and seen. Von Bergmann removed an angiosarcoma successfully in much this same manner.

This is a good type of exposure (Plate VIII), and is the one to be preferred where the lesion is one-sided, in the frontal lobe, encroaching upon the sensory motor area. This will include tumors or disease involving the anterior part of the first, second and third frontal convolutions, tumors of the frontal lobe encroaching upon the posterior part of the first and second convolutions or ascending frontal convolution in which, to the frontal symptoms, are added gradually, motor disturbances involving the trunk, the head, neck and eyes or speech. Tumors of the white substance, with marked psychical disturbances and later intermittent motor symptoms, are also accessible. By raising the frontal lobe, one can obtain a view of any tumor present upon the inferior surface of this lobe. These tumors have been described by von Bruns, by Dupré and Devaux. By retracting outward the frontal lobe, the median surface can be partially exposed, and the first frontal convolution upon the median surface can be seen. Tumors situated in this frontal convolution, and especially in its anterior half, have been quite easily removed, and we may cite here a case of Labbé (Société Anat., 1896, p. 762).

In this region of the brain I have had 15 cases. Of these cases, only 7 are available, since we do not wish to include any cases unless we have heard from them at several long intervals following their operation, or, in case of death, have

obtained an autopsy. The operative recovery of a case has but little significance unless functional restoration accompanies it.

CASE I.—B. C., March 6, 1891, Roosevelt Hospital. Discharged April 13, 1891. Male, twenty-four years of age. *General symptoms*: Vertigo; mental torpor, almost unconscious periods; intense headache. *Localizing symptoms*: Paresis of right arm; motor aphasia; agraphia. *Diagnosis and location*: Compound fracture, subdural cyst or adhesions. Ascending frontal and posterior part of third frontal. *Operation*: Trephine; removal of bone with rongeur forceps; replacement of flaps without bone. *Result*: No cyst; adhesions found binding pia, dura and brain substance. Removal. Improved greatly; died in 1893 without a return of symptoms. Could walk and write well; no aphasia.

CASE II.—M. A. N., March 11, 1892; discharged April 29, 1892. Male, thirty-two. *General symptoms*: Double optic neuritis. Vision lost in right eye five years ago. Injury to skull twelve years ago. Gradually increasing frontal headache and mental apathy. *Localizing symptoms*: Convulsive movements in right arm, head and neck. Distinct aura of nausea preceding each attack. During all attacks all sounds are exaggerated. No loss of consciousness. *Diagnosis and location*: Cerebral traumatic cyst, posterior part of the second frontal and ascending convolutions. *Operation*: Large trephine and rongeur forceps over the fronto-parietal region. Dura incised, nothing found. Second trephine over the external angular process of frontal bone—dura incised, nothing found. *Result*: Not improved. Fifteen months later patient died, and autopsy showed a traumatic cyst, situated over the posterior part of the second frontal, ascending frontal and parietal convolutions. This cyst communicated with the lateral ventricle.

CASE III.—S. I., May 16, 1893. Roosevelt Hospital. Discharged June 27, 1893. Male, fourteen. *General symptoms*: Headache, gradually increasing after injury three years ago. *Localizing symptoms*: Convulsive movements in face, neck and arms. No loss of consciousness. *Diagnosis and localization*: Traumatic cyst or adhesions, the result of the compound fracture over the frontal and parietal lobes. *Operation*: Horseshoe flap trephine to the side of the ¾-inch cicatrix between dura and

scalp. Removal of cicatrix and exposure of the pia mater. Traumatic cyst found, containing 2 drachms of fluid. Removed entire. Flap replaced. *Result*: Patient improved. No attacks for sixteen months. Lost sight of until May 3, 1900. No return of symptoms at that time.

The first of these three cases is interesting in that without more than a removal of the adhesions and a perfect wound healing a perfect functional result took place. The second and third cases are of interest in that in one the cyst was not found and the patient ultimately died, probably as a result of it. While in the other the finding and removal of the cyst resulted in both an operative and functional recovery. In both traumatic cysts the injury and the gradual progression of the headache, the repeated attacks of convulsive movements, the trouble of vision, and the mental apathy, pointed strongly to the diagnosis and location.

CASE IV.—Mrs. F., admitted July 13, 1894, Roosevelt Hospital. Discharged August 27, 1894. Female, forty-six. *General symptoms*: Headache, more in frontal region than elsewhere. No other general symptoms than mental apathy. Injury to frontal region ten years ago. Symptoms present five years. *Localizing symptoms*: Frontal headache, local tenderness to percussion over a swelling 3¾ cm. in diameter in lower half of left frontal bone. *Diagnosis and localization*: Intracranial dermoid, cholesteatoma or a sarcoma of the frontal bone over the second and third frontal convolutions. *Operation*: Omega-shaped flap including the periosteum. Bone removed by the rongeur forceps. Removal of cyst and contents entire. *Result*: Patient made a complete recovery. Was seen in 1900, February 1, and was then in perfect health. *Diagnosis*: Cholesteatoma.

This case, which has been reported as an intracranial implantation dermoid (ANNALS OF SURGERY, Feb. 26, 1896), showed the characteristic appearances of a cholesteatoma (Ewing). The relation of trauma and the tumor render such a diagnosis very probable. (*Deutsche Zeitschrift fur Chir.*, p. 361, vol. lxx.) This condition is rare, existing three times in

10,000 autopsies (Benda). It is very difficult to distinguish from traumatic cysts, since the relation of trauma and the slow progression of the symptoms are the same in both. In order to obtain a cure a very complete extirpation of the capsule must be made, for, although they are not malignant, they will recur.

CASE V.—Admitted September 12, 1906. Discharged September 15, 1906. Hudson Street Hospital (Dr. Connor). Male, forty. *General symptoms*: No previous history. Unconscious; general convulsions (thirteen in twenty-four hours); stertor; pulse 100; temperature 102°; respiration 24. Reflexes exaggerated. Spinal fluid. No meningococcus. Blood examination, 50,000 leucocytes, 93 per cent. polynuclear cells. Urine negative. *Localizing symptoms*: None. *Diagnosis and localization*: Possible abscess of the brain. *Operation*: None. *Result*: Died without regaining consciousness and with symptoms of hypertension of brain and infection. Temperature ranged between 103°–108°; pulse, 100–152; respiration, 24–48.

Autopsy: Autopsy shows that the organs other than the brain are in good condition. In the brain is situated a hydatid cyst, with a firm but non-adherent capsule occupying the internal and anterior portion of the first frontal and the greater part of the second frontal convolutions. It extends backward to the ascending frontal convolution, but does not displace it, nor does it displace the third frontal convolution. It compresses the posterior part of the first and second convolutions more in the depth than appears superficially. The tumor displaces, but does not invade these convolutions (Dr. Elser, pathologist New York Hospital). The position of the cyst is such as would give no localizing symptoms other than frontal headache, mental apathy, inaptitude for work, and mental inattention. Apparently this was the case until the symptoms of hypertension, unconsciousness and generalized convulsions took place. At this time he was admitted to the hospital, with the meagre history of his headache and gradually increasing torpor. Such cases are mentioned (Estaves and Herrega Vegas, *Chipault Chir. Nerv.*, 1903, p. 881). In this particular case our frontal flap would have exposed it, and not being adherent, it could have been removed easily with its fibrous capsule. See Plate IX.

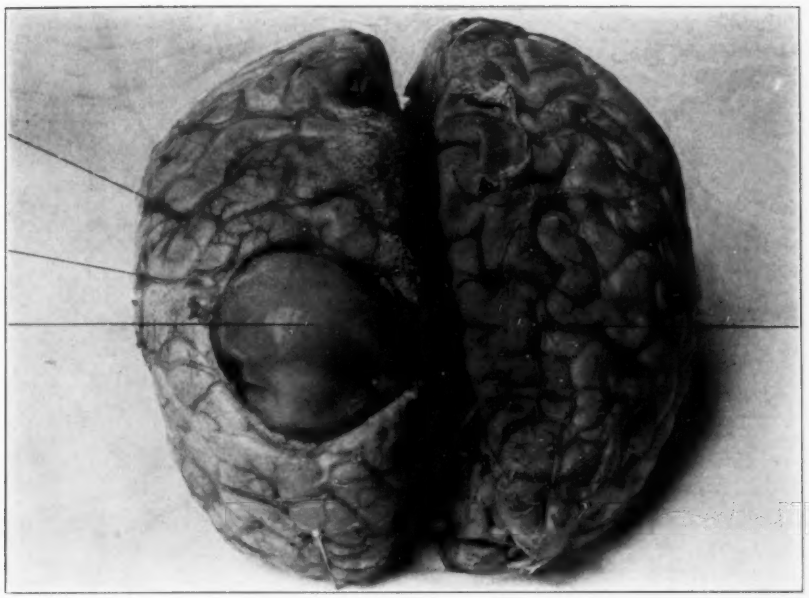

PLATE IX.—Case V. Hydatid cyst. 1. Fissure of Rolando. 2. Præcentral fissure. 3. Cyst. 4. Præcentral fissure.

CASE VI.—New York Hospital. March 22, 1906—March 26, 1906. Male, twenty-seven. *General symptoms*: Old injury to head. No fracture. Three months severe headache. Patient found unconscious in street with convulsion of left side (face, neck and arm). Convulsions during next three days became general. Double choked discs. Babinsky present. Increasing stupor. *Localizing symptoms*: Intense frontal headache, convulsions limited to face and arm—none of the muscles of the head, neck or eyes. *Diagnosis and localization*: Condition at first thought to be due to nephritic poison, later diagnosis of sarcoma or glioma of the face and arm centre in the prærolandic area. *Operation*: None. *Result*: Died.

Autopsy.—The skull cap is unusually thick and heavy. Dura: the external surface is normal. Tension is increased and more marked on the right than on the left side.

The superior longitudinal sinus is normal. The dura is adherent to the pia at one spot over the right frontal lobe; otherwise the internal surface is normal.

Leptomeninges are markedly congested. At one point corresponding to the situation of the tumor described below, the pia is slightly thickened and adherent to dura. The convolutions are flattened and that portion of the right hemisphere situated in front of the præcentral fissure is enlarged and somewhat distorted. The internal surface of this portion of the right hemisphere bulges distinctly, causing a corresponding depression on the inner surface of the opposite hemisphere.

An irregularly spherical tumor, measuring 6 x 5 x 4¾ cm., is found in the substance of the right frontal lobe situated immediately beneath the pia, to which it is attached over an area the size of a half dollar. From this point the tumor projects downward into an excavation in the substance of the frontal lobe. This cavity has the general shape of the tumor and measures 8 x 6 x 6 cm. The space intervening between the tumor and surrounding brain substance is filled with a clear serous fluid. This cavity extends backward to a point on a level with the præcentral fissure, but does not encroach upon the anterior central convolution. Downward it extends to within a few mm. of the anterior horn of the lateral ventricle; outward and forward to within 2 to 2½ cm. from the surface of brain, and inward to within 1 cm. of the mesial aspect of the hemisphere. The internal surface of the

cavity is smooth and traversed by a fine network of injected blood vessels.

The tumor is covered by a distinct capsule, and presents on its surface a meshwork of large injected blood vessels. Its consistence is moderately firm. The cut section is smooth, somewhat mottled in appearance, very vascular, reddish areas alternating with irregular grayish-yellow translucent hyaline areas. The brain substance itself is œdematous. The basilar vessels and basal venous sinuses are all normal.

Microscopic examination of this tumor shows it to be an angio-endothelioma. Dr. Elser, pathologist, New York Hospital.

CASE VII.—New York Hospital. April 10, 1906—April 17, 1906. Male, ten. *General symptoms*: Three weeks ago injury to right side of head. Four days later severe headache and nosebleed, and some twitching of left hand on admission. Marked headache. Complete paralysis of left arm, weakness of left leg. No sensory disturbances. Knee jerk absent. No ankle clonus. Epigastric and cremasteric reflexes diminished, left side. Contusion of scalp over right parietal bone. No ecchymosis. *Blood examination:* leucocytes 12,600 to 8,600; polymorphonuclears 83 per cent. to 74 per cent.; temperature 99.8 to 100.2; respiration 76 to 46. *Localizing symptoms*: Marked headache. Evidence of injury. Paralysis of arm and weakness of leg. *Diagnosis and localization:* Encephalitis, subcortical; Rolandic area, upper and middle thirds. *Operation:* Consent not given. *Result:* Death with increasing stupor.

Autopsy.—The organs other than the brain are normal. Brain: the anterior two-thirds of the right hemisphere is enlarged, swollen and œdematous; the convolutions are flattened. At a point in the posterior part of the right superior frontal convolution is a small irregular perforation which communicates with an abscess cavity, situated in the subcortical white substance, beneath the posterior half of the first and second frontal convolutions. This cavity is filled with a thick creamy pus and measures 2 inches in its transverse and 1½ inches in its vertical diameter. The outer margin of the pyogenic membrane lining the cavity is fairly well defined. The abscess is situated just anterior to the Rolandic fissure, with the exception of the subcortical projection fibres of the arm centres. It does not encroach upon the basal ganglia.

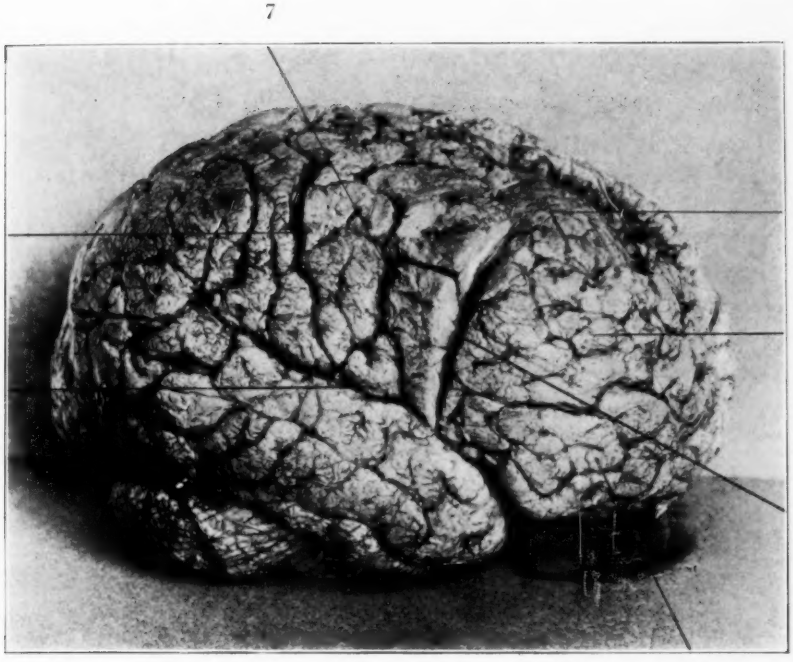

PLATE X.—Case VI. Angio-endothelioma. 1. Tumor. 2. Second frontal convolution. 3. Incision into brain, exposing the lateral aspect of the tumor. 4. Third frontal convolution. 5. Sylvian fissure. 6. Rolandic fissure. 7. Præcentral fissure.

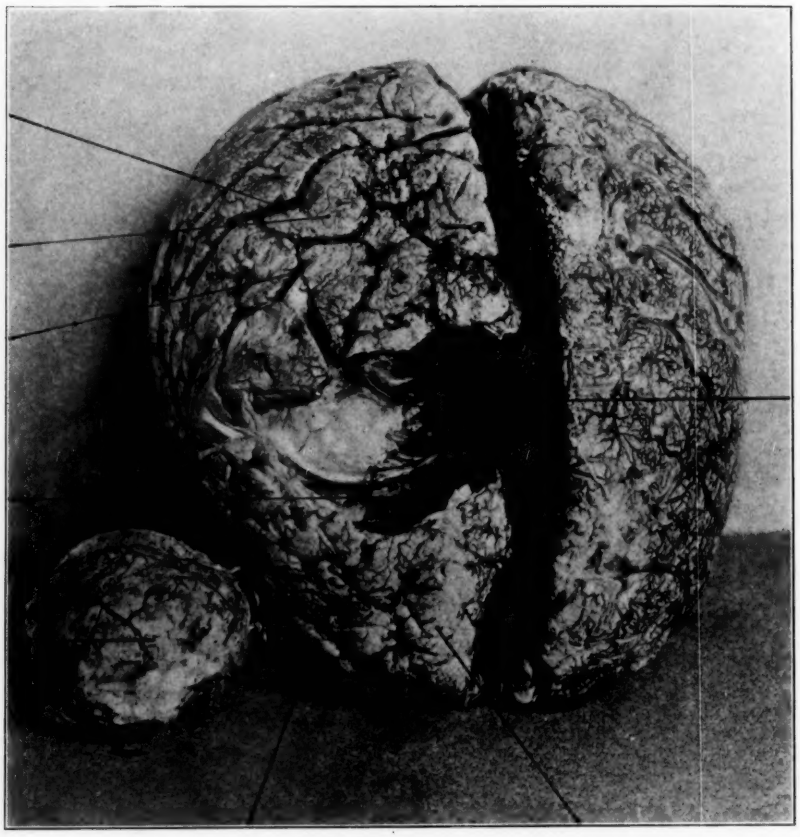

PLATE XI.—Case VI. Angio-endothelioma. 1. Tumor removed from the brain. 2. Middle frontal convolution. 3. First frontal convolution. 4. Anterior horn of lateral ventricle. 5. Displaced first frontal convolution. 6. Rolandic fissure. 7. Præcentral fissure. 8. Ascending frontal convolution.

The location of the tumor is the posterior half of the first and second frontal convolutions extending into the longitudinal fissure. In the depth it extends further posteriorly than is apparent from the photograph. The first and second frontal convolutions have been compressed, but not invaded by the tumor. The ascending frontal convolution has been slightly compressed superficially, but the main compression is below the cortex, in the *corona radiata* and white substance. As observed by those who saw the earlier convulsions, they were limited to the face and arm, without involvement of the muscles of the eye, the head or the neck. Upon admission, the convulsions became general, and no distinctive involvement of the posterior part of the first and second convolutions was observed. The case is characterized by an old injury, with fracture, intense local and frontal headache, and convulsive movements limited for a time to the face and arm (not well observed), and finally general convulsions.

It is to be deplored that the earlier convulsions could not have been more accurately observed, and an early operation attempted.

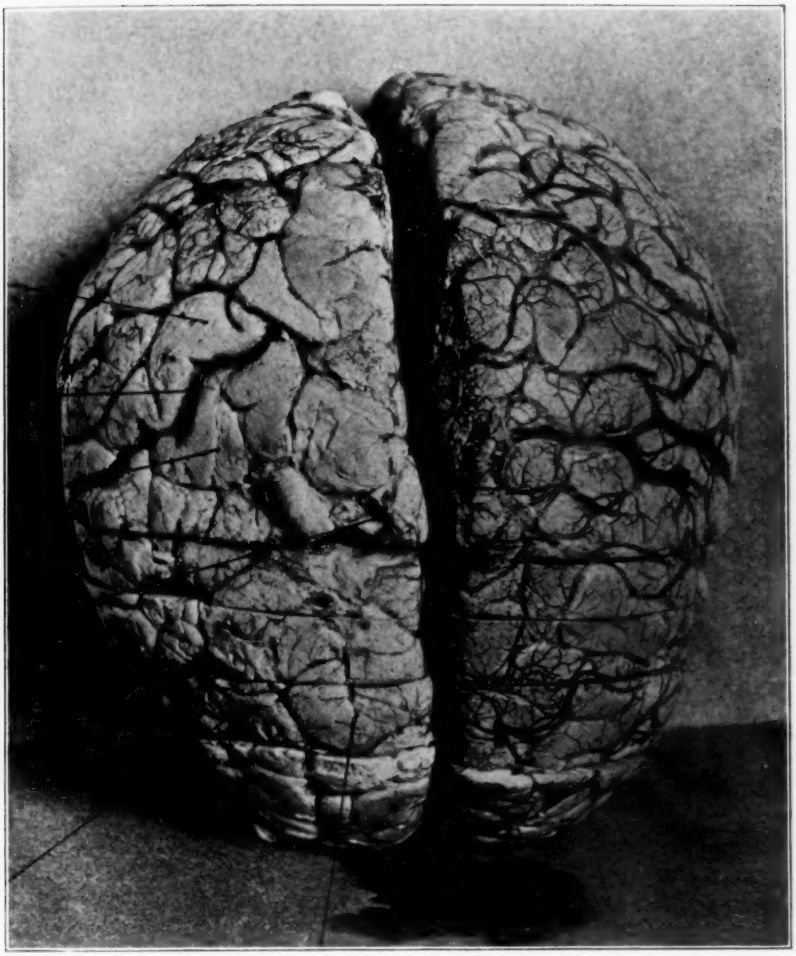

PLATE XII.—Case VII. Encephalitis with abscess. 1. Ascending parietal convolution. 2. Rolandic fissure. 3. Ascending frontal convolution. 4. Tract of infection from the fracture of the skull. 5. Third frontal convolution. 6. Second frontal convolution. 7. First frontal convolution.

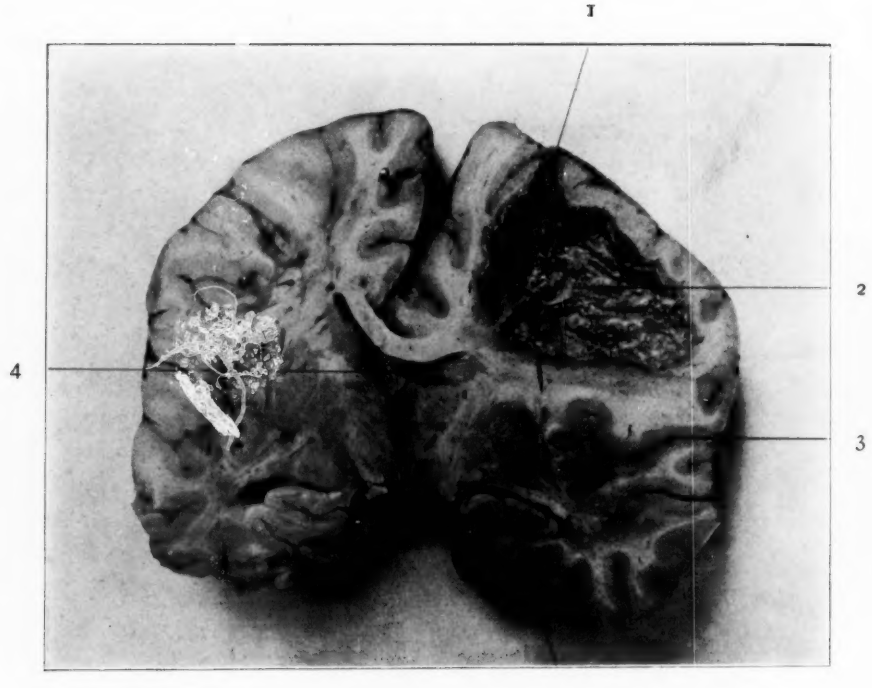

PLATE XIII.—Case VII. Encephalitis with abscess. 1. Track of infection from the fracture in the skull. 2. Contents of abscess cavity. 3. Fissure of Sylvius and Island of Reil. 4. Lateral ventricle. 5. Descending horn of the lateral ventricle.

The bone directly over the perforation communicating with this subcortical abscess is contused (ecchymosis) and shows a compression fracture involving the diploe with a linear crack in the internal plate, beneath which the dura is adherent to the pia. Except at this point, there is no evidence of a pachy- or leptomeningitis.

Bacteriological Examination of the Pus.—Film preparations show many very long chains of streptococci, apparently in pure culture. Cultures from the pus reveal a pure culture of the streptococcus pyogenes.

Ante-mortem cultures made from the spinal fluid remain sterile. No evidence of any sinus or ear disease. Dr. Elser, pathologist, New York Hospital.

The characteristic symptoms here are, (1) The injury to the skull; (2) The severe headache localized to the parieto-frontal region; (3) Tenderness on percussion over this region; (4) The slow pulse rate, 46 to 76; (5) The temperature, 99° to 100°; (6) The blood examination, 8,600 to 12,600 leucocytes, 74 to 83 per cent. of the polymorphonuclear lymphocytes; (7) Microscopic and bacteriologic examination of the cerebrospinal fluid; (8) Focal symptoms limited to the arm and leg; (9) Increasing cerebral hypertension without evidence of meningitis. These symptoms were noticed two and a half weeks after the injury, and continued with increasing stupor and choked discs until death. They were preceded by headache, nose-bleed and slight cortical irritation involving the hand centre, commencing four days after the injury and gradually increasing until admission to the hospital two and a half weeks later. It is to be deplored that an operation could not have been done. Both sides of the frontal lobes must be exposed in most tumors situated in the neighborhood of the optic chiasm, the beak of the corpus callosum, and the internal surface of the frontal lobes (Goldenarm and Winkler, " Chir. Nerv.," Chipault, 1902) or upon the supra-orbital surface of the frontal lobe (Dupré and Devaux, " Iconogr. Salp.," 1901, Bruns, Neurol., *Centralblatt*, 1898).

Two methods of operation have been proposed for this region. Both are cadaver operations.

1. Kiliani (ANNALS OF SURGERY, July 1904), recommends for tumors of the hypophysis cerebri a flap with a pedicle just beyond the coronal suture, its sides just beyond the temporal ridges, and its lower border following the usual curve of the frontal sinuses; that is, 1.5 cm. above the orbital margin of the frontal bone externally, near the temporal ridges, and 3.75 cm. above the root of the nose in the median line. This method has its base of 8.75 cm. for its blood supply in the parietal bone at the convexity of the skull where the bone is the most curved and is the thickest. This means that to break it where one wishes, the pedicle must be weakened and somewhat narrowed. Kiliani's operation, however, has the great advantage of following, so far as one can, the margin of the frontal sinuses, and of giving a good exposure without opening the sinuses. The operation is, however, done with a fraise, and the slit left does not allow complete apposition of bone, so that the bone flap rests upon the dura mater, and the healing cannot be so exact as when the bone is in apposition.

2. Duret ("Les Tumeurs de l'Encéphale," 1905), recommends a flap with its pedicle 6 cm. wide, 1.5 cm. above the supra-orbital margin. Its base is situated beyond the coronal suture; its sides extend beyond the temporal ridges. Its arterial supply is through the supra-orbital and frontal arteries. The frontal sinuses are not infrequently opened, a fact which Duret thinks of little importance, as they can be drained. Duret's operation is done with the Gigli saw and the Marion guide. We cannot agree that the opening of any mucous sinus communicating with the nose is an immaterial thing, and we therefore prefer Kiliani's idea of circumventing the sinuses. Our method, we think, gives as good a field as either of these, and, at the same time, allows a ready breakage in the bone at its thinnest portion, namely, the temporal fossa. Our cutters and saws divide the thickest parts of the bone very easily, and for this reason we always make our pedicle (in all flaps) in the thinner sections of the bone.

3. Our flap is a double one, each side of which is made much in the same manner as our flap for exposing one side of the frontal region. Our pedicles are situated in the thin bone of the temporal fossa. Our incision begins externally to the temporal ridge in the neighborhood of the stephanion, crosses the ridge 1.75 cm. above the orbital margin, that is, just above the superciliary ridge, ascending gradually (Kiliani) until a point is reached 3.75 cm. above the root of the nose. Here the incision crosses the median line and descends in a similar manner to a point beyond the temporal ridge, corresponding to the point of commencement. Another incision is now made across the vertex, about 12 cm. long, situated in front of the præcentral line and behind the coronal suture. This line begins and ends just to the side of the temporal ridge. Another incision bisects these incisions just to one side of the median line. Hæmorrhage is arrested by ligature of the arteries, by the buttonhole suture or by the tourniquet. The periosteum is retracted, and the cutter is used. One hole is made at the temporal ridge near the stephanion on each side. One hole at a point 3.75 cm. above the root of the nose, to each side of the median line. Four holes in the upper incision, two at 1 cm. to either side of the median line, two at 4 to 5 cm. in the temporal ridge,—that is, at the extremities of the upper transverse incision. In the vertical incision, to one side of the median line, one hole is made. No more holes are necessary unless the disparity in depth is great between two holes. In that case, another hole may be made to determine the depth. As we usually select a saw 2 mm. less than the actual measurement, we always have a fair margin of safety which we can greatly increase by a bevel. After the bone is sawn, the smaller of these two bone flaps is removed by an osteotome inserted at the point where one noticed that the bone was less divided than elsewhere,—that is, at the thicker portions of the bone. One or two strokes of the mallet upon the osteotome loosens the flap and then it can be raised and broken at its pedicle in the temporal fossa. The other bone flap may be broken in the same manner after loosening the longitudinal

sinus. After the flaps are raised, the dura is exposed and the bleeding from the vessels in the longitudinal sinus are tied. Inspection of palpation of the undivided dura is made. If shock is impending, the operation is discontinued, and is performed in two stages. If so, the bone flap is replaced over gauze packing, and in from seven to fourteen days the operation is renewed.

At this time the procedure will vary, depending upon whether the tumor or cyst can be appreciated upon one side, or whether both sides must be exposed with the dural flap. If one side alone, a dural flap, with its base at the longitudinal sinus, is sufficient. If both sides, or the orbital face is to be exposed, the longitudinal sinus is ligated close to its attachment to the ethmoid and the falx cerebri is divided (Kiliani). The incision in the dura is carried laterally, following the margin of the bone incision, with the base above. The dural flap is raised, spoon retractors are introduced, and the two frontal lobes are raised, exposing at first the olfactory bulbs and the optic chiasm, and later the anterior and middle cerebral arteries between and behind which the hypophysis cerebri is seen. Further back than this level the opto-peduncular space can be seen, though it cannot be reached. Laterally, the orbital surface of the frontal lobes is exposed. Kiliani has looked over 42 cases of tumor involving the hypophysis cerebri, a large number of which were cases of acromegaly, while others were tumors of the pituitary gland, but without symptoms of acromegaly. In no instance have these tumors been removed. In Kiliani's own case the enormous vascularity forbade any such attempt. In 3 cases reported by Horsley the tumor has been successfully removed, with one recurrence (*British Medical Journal,* August 23, 1906). Likewise in the opto-peduncular space, though four tumors have been diagnosticated before death, and found on autopsy, none have been removed.

For tumors and disease of the anterior fossa arising from the bones, the falx or the meninges, this method of incision allows an opening at first upon one side and then upon the other, if necessary. In this manner the operation per-

formed may be accomplished at one sitting, and upon one side if limited and diagnosticated correctly. If extensive, and involving both sides, the bilateral flap may be cut at once. It may be done at one or two stages.

I have had but one case involving this region, and requiring the exposure of both sides at once. This case is Case VIII.

CASE VIII.—H. S. January 30, 1906. Discharged March 17, 1906. Male, thirty-three. *General symptoms*: Eighteen years ago fell and injured skull in frontal region. Seven years later severe headache over the injury occurred. One year ago button of bone was removed, and later two pieces of dead bone. Symptoms of severe headache and pressure beneath the scar remained. A gradual change in his character took place, in which he showed signs of moral perversion. *Localizing symptoms*: Injury, frontal region, headache. *Diagnosis and localization*: Pressure from adhesions. *Operation*: Large quadrilateral flap, base 3 cm. above supra-orbital margin, involving both sides of skull, 9.5 cm. transversely, 7 antero-posteriorly. A thick, dense mass of adhesions involving both frontal lobes (over longitudinal sinus and the first and second frontal convolutions). Removal, Cargyle membrane and replacement of flap. Implantation of celluloid plate, 9.5 x 7 cm. *Result*: Recovery. Relief of headache immediately. Primary union except one small spot where the skin flap necrosed. Secondary plastic. Discharged March 17, 1906. No subsequent changes in moral tone. Headache relieved. October 10, 1906, still healed, no headache, no moral change. January 1, 1907, still free from headache; no other change.

Upon the lateral aspect of the brain the cortical centres for motion, sensation, motor aphasia, word-blindness, or word-deafness and hearing are included in the posterior third of the frontal, the ascending frontal, the ascending parietal, the superior and inferior parietal, the supramarginal, the angular and the first and second temporo-sphenoidal convolutions. This includes:

1. Tumors and disease involving the superior Rolandic and præcentral lobe, a region especially predisposed to the tuberculomata.

2. It includes tumors of the middle Rolandic area (Duret, p. 225, loc. cit.).

3. Tumors and disease of the inferior Rolandic area.

4. Tumors and disease involving a part of the superior parietal convolutions.

5. Tumors and disease involving the inferior parietal convolution and the supramarginal convolution.

6. Tumors and disease involving the first and second temporo-sphenoidal convolutions, in their central and posterior portions.

Tumors and disease under 1 involve the lower extremity; under 2, the upper extremity; under 3, the face, language, and movement of the jaws especially; under 4, alterations in the superficial and deep sensibility are marked symptoms; under 5, astereognosis and deep sensibility are particularly involved; under 6, disturbance in hearing is a marked symptom, and upon the left side, in addition, we have manifestations of sensorial aphasia, except in left-handed people. On the right side sensorial aphasia is wanting, except in left-handed people. We bound this region by an imaginary line, including the posterior half of the frontal convolutions in front, the median line above, the second tempero-sphenoidal sulcus below and the occipital lobes behind. This area includes the whole sensory-motor area which, in order that the flaps be not too large, may be divided into two regions—the motor-sensory or anterior half, and the sensory-motor region, the posterior half. These two regions may, when the necessity arises, be exposed by one flap. But when the symptoms are definitely motor and then sensory, or first sensory and then motor, the anterior or posterior portions may alone be exposed.

It is our practice, unless symptoms are definite, to expose this region by one flap, but we will describe this operation in two flaps. The first flap is bounded by a vertical line one finger's breadth in front of the prærolandic line anteriorly and by a vertical line marking the parieto-occipital fissure, which fissure is found at the posterior extremity of the Sylvian line. The base of this flap is the squamous portion of the temporal

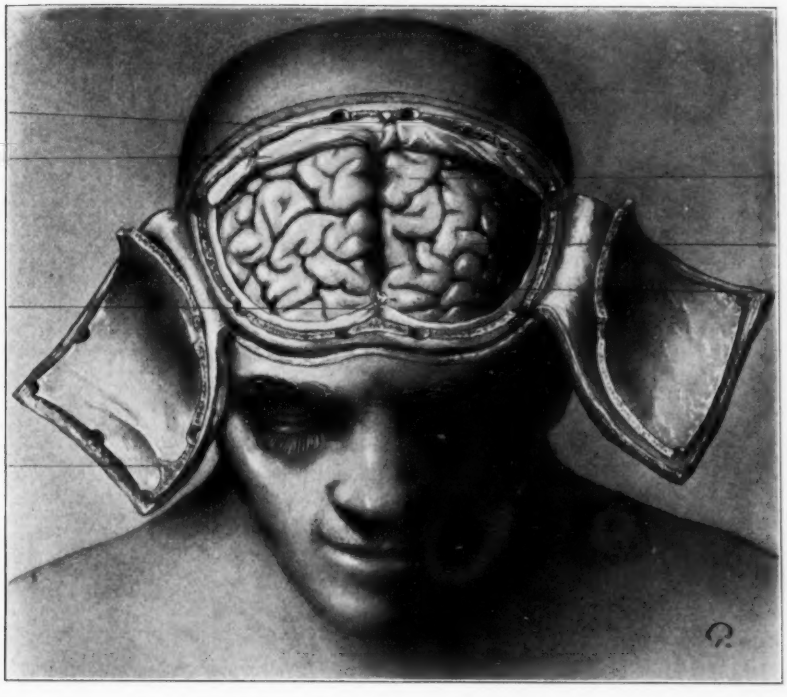

PLATE XIV.—1. Superior longitudinal sinus. 2. Dural flap (rolled up). 3. Superior longitudinal sinus. 4. Frontal crest. 5. Superior frontal convolution. 6. Middle frontal convolution. 7. Inferior frontal convolution.

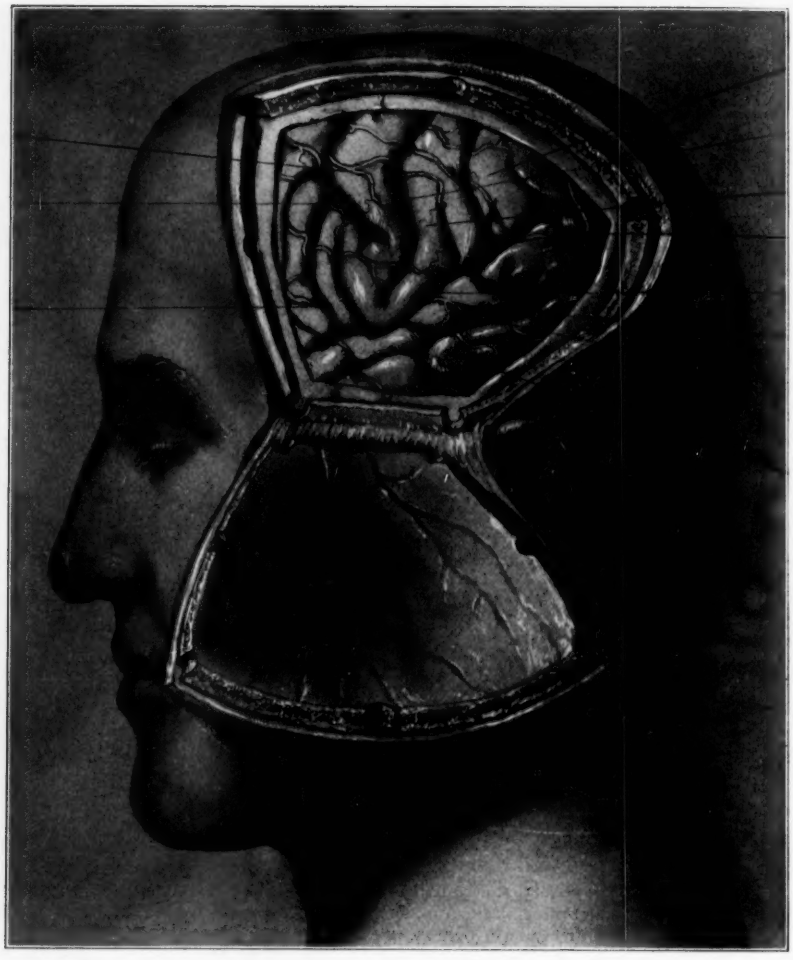

PLATE XV.—1. Ascending frontal convolution. 2. Præcentral sulcus. 3. Ascending limb of the Sylvian fissure. 4. Inferior parietal convolution. 5. Fissure of Rolando. 6. Ascending parietal convolution. 7. Supramarginal convolution. 8. Fissure of Sylvius. 9. Superior temporo-sphenoidal convolution. 10. First temporo-sphenoidal sulcus. 11. Second temporo-sphenoidal convolution.

bone. The incision is usually commenced upon the anterior and posterior limits. This is followed by the incision 1 to 1.5 cm. from the median line, uniting the upper extremities of the other incisions. Usually, four to six holes are drilled, and measured. In addition to these two or three holes may be drilled to determine any variation in the depth of the skull between these openings. It is not necessary to drill all of these holes, as the second two or three are only for the purpose of determining any great variation in the thickness of the skull. Because of the Pacchionian bodies, these extra holes are sometimes important in the line between the upper extremities of the first incisions. They are equally important at the margin of the temporal ridge, since the variation in depth not infrequently ranges from 1 to 10 mm., and one must know where to bevel and where to saw straight. The bone flap having been sawn, is raised and broken in the temporal fossa. The dura is inspected and palpated and a flap cut. Our flap has usually been with its base above. This is reflected after the middle meningeal artery is tied. It often does not bleed after separation of the dura from the bone if some compression is exerted. If it does not stop, it can be easily ligated. No fear should be had for this artery; no more so, indeed, than in the extirpation of the gasserian ganglion, where it is practically neglected as a factor for or against any particular method of procedure. After reflection of the dura, the field exposed is seen in Plate XV. This, as we can see, gives a full view of all that is necessary about the motor area and, provided localization has been fairly accurate, it should give one sufficient adjacent exposure to correct any slight error. The question of a subcortical or cortical tumor can be best determined, providing the area exposed is extensive.

The number of cases operated upon in this region, of which we have definite information, is 15: 4 traumatic cysts, 1 non-traumatic cyst, 3 cases of adhesions following depressed fracture of the skull or laceration of the brain; 1 endothelioma, 1 gliosarcoma; 1 laceration and hæmorrhage; 4 cases of exploratory operation. The number operated upon but of

which we have no definite knowledge, either by autopsy or examination, longer than one year after operation, is 13.

Case IX.—A. T. M., Roosevelt Hospital, October 6, 1892–December 26, 1892. Male, twenty-one. *General symptoms*: Injury to head fourteen years ago, followed by aphasia and hemiplegia of right side for eight months. Slowly improved and for seven years was well, speech being slow and hesitating. Seven years ago first convulsions, limited to right side at first, then general. During seven years, convulsions have slowly increased in frequency. *Localizing symptoms*: Injury over motor area. Paralysis with recovery, followed by Jacksonian epilepsy, slowly increasing in severity. No sensory disturbances. *Diagnosis and localization*: Hæmorrhage and cyst. Rolandic area. *Operation*: Trephine and chisels. Omega-shaped osteo-periosteal flap, exposing centre of Rolandic area. *Result*: Cyst found 1½ inches in diameter between dura and pial coats. Dissected away, and flap replaced. Small trephine opening used for drainage. Patient seen 1901, still free fron convulsions.

Case X.—J. H., January 5, 1892, Roosevelt Hospital. February 28, 1892. Single, fourteen. *General symptoms*: Ten years ago fracture of left parietal bone, following which an abscess developed and was incised. Fifteen months ago fell again and struck old spot. This was followed immediately by petit mal. Aura began by numbness in right hand, then flexor spasm in right arms and leg. Such attacks have been repeated frequently (Dr. Starr). *Localizing symptoms*: Aura and Jacksonian attacks in arm and leg: *Diagnosis and localization*: Cyst, result of subdural hæmatoma. In the middle and upper part of Rolandic area, rather posterior than anterior. *Operation*: Quadrilateral-shaped osteoplastic flap removed with chisels over the posterior part of Rolandic area, 8 x 6 cm. Two small communicating cysts removed, situated between the brain and the dura and pia mater. *Result*: Discharged February 28, 1892. Readmitted January 6, 1893. Six months ago convulsion in right side recurred. January 7, again operated and a small cyst removed from original site, including a wedge-shaped mass of brain and scar tissue. Drained. Discharged February 10, 1893, no recurrence of symptoms. In 1889 patient died of pneumonia without at that time having had a recurrence of the convulsion.

CASE XI.—B. C. November 22, 1893, Bellevue Hospital. Discharged December 17, 1893. Male, thirty. *General symptoms*: Fourteen months pistol shot in right parietal bone; ten days later paralysis of right arm and leg, no loss of sensation three and one-half months; gradually recovered. For ten months slight Jacksonian epilepsy, limited to right arm and leg, preceded by headache (severe). *Localizing symptoms*: Depression at site of an old scar, 3.75 x 1.25 cm. The centre of this scar is over the Rolandic area. Jacksonian attacks. *Diagnosis and localization*: Traumatic cyst or adhesions without cyst. *Operation*: Flap, osteoplastic—exposing Rolandic area. Bone found adherent to dura. Beneath it a small cyst found holding 10 c.c. and a small spiculum of bone from the inner table. Removal of wall and drainage. *Result*: Recovery. Discharged December 17. In 1901, heard from; still free from Jacksonian attacks.

CASE XII.—H. F. S., New York Hospital. Admitted February 23, 1905; discharged March 14, 1905, cured. Male, twenty-six. *General symptoms*: When five years old, fell and drove a nail into right side of head. Nail was immediately removed, but during the healing the entire left side of his face and body became paralyzed. This paralysis gradually disappeared, and he was perfectly well for five years, when he began to have epileptic attacks, at first once in every four or five weeks. Attack began by twitching left corner of mouth, then neck, shoulder, elbow, wrist, fingers, thumb, side of body and leg. Sometimes loses consciousness, other times does not. Never falls, has to lie down sometimes; bites tongue. Frequency steadily increased, occurring both day and night, and became so bad that four years ago he was trephined and a cyst removed from brain. No attacks for six weeks, when convulsions began again. For last two to three weeks has two or three attacks both day and night. Between attacks he is perfectly well. *Localizing symptoms*: Scar on right side of head—old trephine. *Diagnosis and localization*: Traumatic epilepsy. A cyst. (Dr. Spitzka.) *Operation*: Osteoplastic flap, quadrilateral in shape (3 inches to a side), exposing the site of old operation. Skull thick, 7 to 10 mm. Dura opened by a crucial cut over site of old injury. Multiple cysts found in region of posterior central convolution. These extended 4 cm. (1½ inches) below surface of brain. All cysts evacuated, fibrous cyst wall dissected out as completely as possible. Hæmorrhage easily

controlled by slight pressure. Dura stitched back in place; small gauze packing at upper posterior angle of wound to control oozing and for drainage. *Result*: Cured. Drain removed on fifth day. All sutures out by eight day. All dressings off on thirteenth day. Left hospital on seventeenth day. Wound solid, primary union. Has had no convulsions. For eight days after operation, temperature 99° to 103.4°, pulse 88 to 120, respiration 18 to 24, then a gradual return to normal. Seen October, 1906. No return of symptoms.

The characteristic points in these cysts seem to be the long period between the original injury and the operative interference, during which time there was progressive increase of the symptoms, from the headache, the paresis or the convulsive attacks and apathy at the times of the injury, to the development of the more pronounced symptoms of cerebral hypertension.

The three stages of such cysts are marked in our 4 cases: The traumatism, epileptic seizures or spasmodic hemiplegia, and the period of intracranial hypertension. Of these 4 cases, 3 were cured, and 1 was unimproved.

CASE XIII.—I. T., New York Hospital, May 10, 1899–July 10, 1899. August, 1900–January 1, 1901. Female, aged thirty-four. *General symptoms:* Nine years ago began to have epileptic seizures, repeated three or four times a year, lasting three or four minutes. Attacks became more severe and more localized in right side of face and right arm. No injury. At present the convulsions are continuous, lasting for days at a time, with but slight intervals. Loss of consciousness. *Localizing symptoms*: Localized, right-sided facial and brachial convulsions (Dr. Peterson). *Diagnosis and localization*: Possible tumor situated in lower third of Rolandic area. Cyst holding 3 drachms found, opened, cut away and drained, communicating with small opening in lateral ventricle. Drainage was excessive and cure tedious. Cured for thirteen months. Return of convulsions. January 1, 1901, second operation, cyst found with many adhesions. Fifteen days after operation convulsions ceased, *i.e.*, with the removal of the drainage and the complete healing

of the wound. *Operation*: Quadrilateral flap from præcentral line to Sylvian line posteriorly, and from the Sylvian line to 1 cm. of median line. Rolandic area exposed. *Result*: After second operation the convulsions were limited to slight twitchings of arm and face at long intervals; this continued for one year, when they became more general, about one a month. (No cure.)

This was a cyst, so far as the history can be obtained, of non-traumatic origin. It communicated by a very small opening with the anterior portion of the ventricle, and was situated beneath the third frontal and ascending frontal convolution. I have always believed that this cyst was of congenital rather than traumatic origin, since no traumatic history has been obtained. It is remarkable that during the drainage, and after the first operation, the convulsions were at long intervals, and consisted of only slight twitchings of the face and of the arm. This continued for one year, when the attacks recurred. Upon reopening the operative field, the remains of the cyst were found, together with many adhesions. Drainage was again employed and relief for about one year occurred, at which time the patient died in a severe convulsion, and no autopsy could be obtained. In some respects, this case is similar to those cases reported by Kocher (*Deutsche Zeitschrift fur Chir.*, 1893).

The following are 3 cases of adhesions:

Case XIV.—G. N. June 13, 1902–July 7, 1902, New York Hospital. Single, twenty-one. *General symptoms*: Injury to right side of head eight years ago. Two years ago first fit, next year two fits, next year three fits. These, as observed, consisted in Jacksonian attacks, confined to the hand and face. During last two years these attacks have become more general, and are attended with loss of consciousness during last year. *Localizing symptoms*: Injury—Jacksonian attacks. *Diagnosis and localization*: Adhesions or cysts. Middle Rolandic area. *Operation*: Osteoperiosteal and muscle flap, 8 x 6 cm., exposing area. Centre of flap is slightly depressed and the seat of old depressed fracture. Well marked adhesions below dura and brain. Removed. Rubber tissue inserted. Depression in bone (3 x 2 cm.) cut out, and cel-

luloid implantation. *Result:* Discharged July 7. Improved. Improvement only temporary—three months fit recurred. No further operative investigation. No further information.

CASE XV.—R. W. New York Hospital. October 25, 1892–December 10, 1892. Single, male, aged twenty. *General symptoms*: One year ago injury to head, left parietal region; was unconscious for several hours, unable to speak, and right hemiplegia for one hundred and forty-two days. Recovered and began to have slight twitchings, limited to hand, arm and leg. These have continued at intervals. *Localizing symptoms*: Jacksonian attacks. Old scar and depressed bone. *Diagnosis and localization*: Depressed bone with adhesions. *Operation*: Omega-shaped flap, skin, muscle and pericranium. Trephine and rongeur for bone, elevating the depression; pieces saved and replaced. Adhesions removed between dura and brain. *Result*: Recovery from operation. No improvement in condition, although patient feels better and speaks better, but the same conditions persist. Though a lesion was found and removed, it must have been imperfectly done, as the same conditions have recurred.

CASE XVI.—W. B., waiter. New York Hospital. February 19, 1906–March 12, 1906. Male, forty-seven. *General symptoms:* Injury to head eighteen months ago. Unconscious at times and for one-half hour. Was operated on for fractured skull; healed in three months. For two or three days after injury, motor aphasia (slight and only when excited did he have difficulty in speaking the word). For eight months has had some irregular sensations, as ringing in ears, spots before eyes, nervousness and paraphasia (motor). Feeling of numbness in right hand and at times inability to hold tightly any object. *Localizing symptoms*: Paraphasia, numbness of right hand below wrist and in foot up to the ankle (Dr. Spitzka). Scar with depressed bone in the frontal and parietal region, 4.75 x 2 cm. *Diagnosis and localization*: Old compound depressed fracture, adhesions and pressure upon brain, rather than a traumatic cyst, involving middle of Rolandic area (Dr. Spitzka). *Operation*: Osteoperiosteal muscle skin flap, exposing the middle Rolandic area from frontal lobes to centre of parietal lobes, *i.e.*, from præcentral to Sylvian lines, and from tempero-sinusal line to 2 cm. from sagittal suture. Transverse diameter of flap is

8 cm. Flap raised with dural adhesions. Dissected away from the pia mater and skull and skin. The space devoid of bone and the pia and brain exposed by removal of adhesions, covered by Cargyle membrane and celluloid plate perfectly shaped—February 24. *Result*: Primary union, March 12. Discharged. Patient feels well and notices no difficulty in pronouncing words which he could not before. Is less nervous. April 27, 1906, no aphasia; working daily. October 17, 1906, no aphasia, full strength in right hand; working daily.

These 3 cases represent injuries with adhesions, and with or without depression of the brain. In one case the possibility of a traumatic cyst was great, though none was found. The remaining cases consisted alone of adhesions. The case of complete recovery was the slightest and the most recent case. It is interesting to observe also that in this case the Cargyle membrane was used to replace the area bared by the removal of the adhesions, and a celluloid plate was inserted into the area bared by the removal of the bone.

The next case was an endothelioma.

Case XVII.—E. R. New York Hospital. March 25, 1905. Discharged April 25, 1905. Male, forty. *General symptoms:* One year before small tumor, sarcoma removed from inner canthus eye; recurred and again removed. Three months ago began to forget words, and two months ago to use words incorrectly. Severe frontal headache, nausea and occasional vomiting; two weeks ago paralysis of right arm for fifteen minutes and aphasia. Morning of admission became unconscious; some aimless movements and twitching of right arm. Several small subcutaneous tumors exist on the trunk. *Localizing symptoms*: Paralysis of right arm and aphasia for fifteen minutes, followed later by twitching movements in same area and gradually increased pressure. *Diagnosis and localization*: Endothelioma, middle part of Rolandic area. Dr. M. A. Starr. *Operation*: Flap described for anterior part of lateral surface, 10 cm. x 8 cm., duration fifty-three minutes. Tumor found as diagnosticated by Dr. Starr. Tumor measures 3.75 x 3.12 x 2.6. Cavity lined with Cargyle membrane and closed.

Result: Uninterrupted recovery. Discharged April 22. Mental powers, can talk, eat, walk well. Microscopic examination, melanoma of endothelial origin. Patient continued in good health for thirteen months; returned to hospital with multiple deposits in abdominal organs and skin, especially in the liver. He died from these without recurrence in brain.

It is to be noted that this patient remained free from all cerebral involvement up to the time of his death, which occurred thirteen months later, and that his death was due to the involvement of other organs than the brain. It may also be noted in this case that the large bone flap, 10 cm. x 8 cm., with a skull of moderate thickness, 5 to 7 or 8 mm., an exact focal diagnosis and an encapsulated tumor required but fifty-three minutes for its removal from the time of the incision to the replacement of the bone flap after suture of the dura.

The next case was a gliosarcoma.

CASE XVIII (Gliosarcoma).—I. S. New York Hospital. October 17, 1903–December 28, 1903. Male, 48. *General symptoms:* December, 1902, suddenly a convulsion, and could not speak for some time afterward. Nephritis being found, the convulsion was considered uræmic. February, 1903, second convulsion. March, 1903, third convulsion—fixation of jaw, peculiar sensation on right side of face. Mental confusion, but no loss of consciousness. Several such attacks have since occurred, involving muscles of eye, right side of face, loss of power of speech, and then right hand twitches and tingles. No loss of consciousness. June, 1903, Dr. Peterson saw him. October 2, 1903, Dr. Starr saw him. Jacksonian attacks still exist from time to time. He has become mentally dull, with an ataxia of right hand. Eyes normal. *Localizing symptoms*: Jacksonian attacks limited to the eye, face and hand. *Diagnosis and localization*: Tumor in lower third of Rolandic area, extending forward to third frontal convolution. *Operation*: October 20, 1903, flap for exposure of Rolandic region made. Flap measured 10 x 8 x 3 cm. Duration one and one-fourth hours. Cystic tumor found as diagnosticated by Dr. Starr. Removed. Measured 5 x 5 and 2½ cm. Cyst wall removed in part. Cautery

to bleeding vessels. Slight gauze packing. October 29, 1903, flap raised. Cyst wall completely removed with brain tissue. Drainage and reclosure of wound. *Result*: Cystic glioma. Discharged December 28, 1903. Mental condition improved. Walked well, talked fairly well in spite of removal of brain tissue. June 12, 1904, readmitted with recurrence and paralysis of upper extremity complete and slightly of lower extremity. Reopening of wound and recurrence. Recovery from operation, but paralysis again appeared. Died January 12, 1905.

In this case it is to be regretted that such an operation could not have been performed at an earlier date. Though the cyst was enucleated, apparently entire, and care was taken in this enucleation, nevertheless a recurrence took place in twelve months, requiring a second and more extensive removal of the growth, with death during the second year, with further increase of the growth.

The next case was one of laceration and hæmorrhage.

CASE XIX.—E. K.; Roosevelt Hospital, May 7, 1891. Discharged June 23. Female, fourteen. *General symptoms:* Fell 25 feet, striking head. Stupor, not unconscious. Pulse 130, respiration 15. Pupils normal. Three hæmatomata, scalp—one over left parietal, one over right parietal, one over right frontal. Paralysis of right arm, leg and face. Aphasia, motor and sensory(?). *Localizing symptoms*: Injury, paralysis of right arm, leg and face. *Diagnosis and localization*: Subdural hæmorrhage, with pressure from blood clot and laceration of brain. *Operation*: Two days after injury, omega-shaped flap, exposing fracture over left parietal bone. A flap with fractured bone (8 x 4 cm.), chisels used. Extensive subdural hæmorrhage. No extensive laceration of the brain. Replacement of flap, and readjustment of bone fragments. Closed. Recovery. *Result*: Wound closed, June 23. Discharged. Speaks and can use right arm and leg. Seen one year later, still in fine condition. A letter received May, 1903, stated her continued good health.

The foregoing case speaks for the immediate operation as soon as the patient recovers from the shock. The com-

pleteness of the cure, and the want of subsequent symptoms referable to this laceration, speak in favor of the early operation.

The following cases were cases of exploratory operation:

CASE XX.—C. E. L. New York Hospital. October 20, 1901. Discharged November 11, 1902. Female, twenty-seven. *General symptoms:* Tubercular family history. Old purulent otitis externa one month ago. Tonsilitis purulent two years ago. Otherwise healthy. Two months ago, without apparent cause, peculiar tingling sensation in left face, leg and arm, followed by loss of power in same. These last a few hours to two days, and are followed by pain in neck back of mastoid. Ringing in head and deafness in right ear, which has a large perforation. Double optic neuritis, more marked in right eye. Tactile and temp. sense normal. Temperature and pulse 100°–112. *Localizing symptoms:* Tuberculous history. Ear disease, followed by sensory and motor disturbances in Rolandic area. *Diagnosis and localization*: Tubercular meningitis or tuberculoma. *Operation*: Omega flap over the ear, exposing temporal fossa in front and Rolandic area and temporo-sphenoidal lobe; negative. Lateral ventricle punctured and negative. Lateral sinus exposed with burr and found normal. Cerebellar fossa exposed by burr and bone removed. Cerebellum negative. Mastoid cells found normal. As no tumor was found in this case, and as the intracranial tension in cerebellar fossa increased over that in cerebrum, a decompressive operation was done here, and the outer wounds were closed with bone flaps. *Result*: Complete recovery after loss of about one-half cerebellar lobe. Has remained well, and free from attacks; sees better than before operation. Seen October, 1904.

CASE XXI.—Mrs. R. New York Hospital, February 18, 1906–March 3, 1906. Forty-two. *General symptoms:* Six months ago intense frontal and occipital headache; at present numbness and coldness of left knee, leg and finally arm. Difficult articulation. Slight photophobia. Nystagmus in left eye. Tenderness on head over right parietal region. Mentally bright. Pupils equal. No optic neuritis. *Localizing symptoms*: Tenderness over right parietal. Paresis of right face, arm and leg. Increased knee reflex. Many slight spasms in left arm during

examination. Constant paræsthesia of left side. Hesitancy in speech. *Diagnosis and localization*: Cortical or subcortical tumor in right parietal region, upper third, posterior to fissure of Rolando. Fibroma (?) (Dr. Starr). *Operation*: Large quadrilateral flap, bounded by the præcentral and parietal lines anteroposteriorly and from the parietal to the median line vertically. Dura exposed, divided, convolutions exposed and recognized. Palpated, incised and punctured with needle; no tumor found. *Result*: Immediate recovery. No permanent recovery.

CASE XXII.—F. H. December 30, 1905. Discharged February 17, 1906. New York Hospital. Male, twenty-six. *General symptoms*: One year ago vision became blurred. Gradually paresis in back of neck and headache. These increased until June, 1905. Right eye showed choked disc. Occasional vomiting, projectile. Right leg and arm gradually paralytic, with occasional twitching of left face. Gradually became drowsy and more stupid. Antisyphilitic treatment. Two months ago epileptiform convulsions on right side, ending in general convulsions and loss of consciousness. Totally blind two months before admission. Otherwise healthy. *Localizing symptoms*: No localizing symptoms, unless paresis of right leg and arm, with twitching of right face. *Diagnosis and localization*: Tumor of brain. Intracranial hypertension. *Operation*: Temporal region on both sides exposed—dura incised. Search made, no tumor found. Tremendous intracranial tension. Suture of the dura. *Result*: Death two days later. No relief of the symptoms, in fact, convulsions were more frequent after than before operation. Just before death: temperature 105°; pulse 120 to 140; respiration 32. No autopsy.

CASE XXIII.—M. C. M. New York Hospital, March 25, 1904–April 10, 1904. Single, female, twenty-seven. *General symptoms:* Supposed injury to skull. For five years attacks of *petit mal,* with unilateral convulsions in left arm, face and leg, followed by *grand mal.* Aura commencing by pain in the head (right side) and followed by left-sided convulsions confined to arm and leg, with at present complete loss of consciousness. All medicinal and hygienic treatment failed. Family history, alcoholic and insane. *Localizing symptoms:* Involvement of arm and leg, pain in head. *Diagnosis and localization:* No specific diagnosis made. Advised exploration. *Operation:* Large quadrilateral flap made, exposed Rolandic area on right side. Nothing

found. *Result:* No improvement after one month. Considered an idiopathic epilepsy.

CASE XXIV.—H. J. November 30, 1892, Roosevelt Hospital. December 29, 1892. Twelve; male. *General symptoms:* Injury to back of head ten years ago. Two hours later convulsion, lost consciousness. One year ago similar attacks, continuing at times eleven hours. Since then has had an attack once or twice a year, followed by temporary paralysis in right arm, leg, aphasia. Mental condition becoming involved. *Localizing symptoms*: Involvement of right arm, leg and aphasia. *Diagnosis and localization*: Hæmorrhagic cyst. *Operation*: Omega flap exposing Rolandic area. Nothing found upon cortex. Some fluid obtained, 1.75 cm. below the cortex, probably from lateral ventricle. Incision of brain substance revealed nothing. *Result*: Recovery from operation. No improvement. Thought to be an idopathic epilepsy, of which the Jacksonian attacks were but an expression.

These 5 cases were exploratory operations only, the diagnosis being a tentative one. In none of the cases was a tumor found. In 2, decompressive operations were performed. In 1, (Case XXII) a temporal flap was made upon each side, namely, beneath the temporal muscle. This patient died two days later. In the other, with several trephine openings and a removal of the occipital bone covering the cerebellar fossa, a complete recovery was effected, and she is still alive, having lost all the symptoms of her apparent tumor. One case must be looked upon as an idiopathic epilepsy, of which the Jacksonian attacks are but a part. (Mills, loc. cit.) In the remaining 2 cases there was nothing found. The patients at present are in the same condition as before.

The next flap (the posterior half of the lateral aspect) exposes the ascending parietal, the superior and inferior parietal, the outer portion of the cuneus, the supramarginal and angular gyrus, and the first and second temporo-sphenoidal convolutions. It is especially destined for those cases commencing with disturbances of sensibility, followed by some disturbance in motion of the extremities, with a gradual hemianopsia and loss of language, or for those cases of sen-

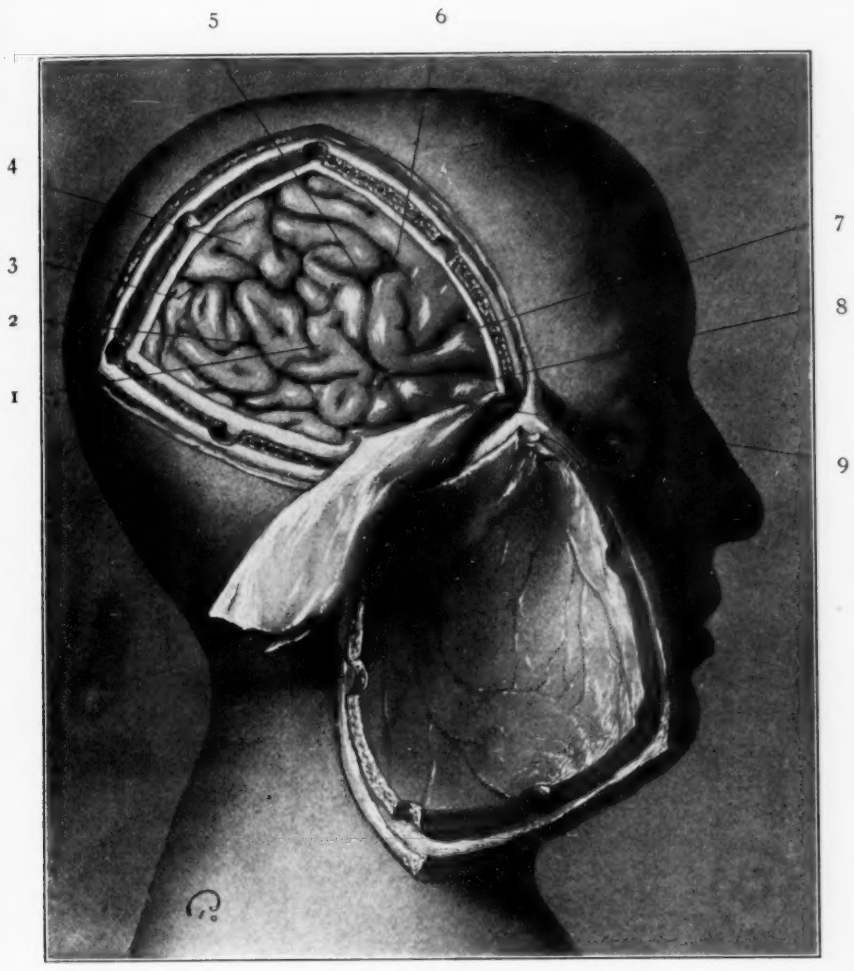

PLATE XVI.—1. Supramarginal convolution. 2. Angular convolution. 3. External parieto occipital fissure. 4. Superior parietal convolution. 5. Inferior parietal convolution. 6. Ascending parietal convolution. 7. Fissure of Rolando. 8 Fissure of Sylvius. 9. First temporo-sphenoidal convolution.

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sorial aphasia commencing with hemianopsia. The area for language is perfectly exposed by this flap, and it includes, as we know, the third frontal, the first and second temporo-sphenoidal and the angular convolutions. This flap is, in every respect, similar to the former except in its boundaries. The flap starts usually from the junction of the præcentral line and the Sylvian line in front. It crosses obliquely the Rolandic line to the sagittal suture at a point just behind the Rolandic line. The lower or posterior limit follows the 80 per cent. line of Chipault. These two lines are connected by a line parallel to the sagittal suture, 1 cm. laterally. The base of the flap is in the posterior part of the temporal fossa. See Plate XVI.

Case XXV.—F. B. January 22, 1904–February 17, 1904. Female, thirty-six. *General symptoms:* Two months ago lost sight of both eyes. Stupid and sleeping most of the time, alternating with excitement, weeping and screaming. This excitement seems due to delusions of various sorts. Eyes: pupils dilated and do not react to light. Right optic disc 2 dioptres; left optic disc ½ dioptre. White swelling. Speech not affected. Motions good in arm and leg. Sensation to touch. Localization delayed in the left side slightly, otherwise negative. X-ray shows a slight shadow near tentorium cerebelli. *Localizing symptoms*: Nothing except the sensory disturbances. These were only slight and were not considered of great value. *Diagnosis and localization:* Probable tumor, endothelioma or fibroma. Probably in occipital lobe. X-ray diagnosis negative. *Operation*: Large rectangular flap, including the left parietal to occipital area from part behind Rolandic area to parietal line. Flap raised. Dura incised. No tumor found, though brain was palpated, incised and punctured. Opening of the opposite side was not permitted, owing to the negative find. Flap replaced without bone. *Result*: Patient grew more excited after operation—tore off dressings. This was followed by an infective hernia cerebri and death February 17, 1904. *Autopsy.*—Right parietal region, an endothelioma, 4 cm., antero-posteriorly, 3 cm. transversely, and 5.5 cm. vertically. Tumor is easily enucleated from the brain except on the mesial side, where it seems to blend with a thin layer of brain tissue.

It seems to arise from the meninges and causes pressure upon the brain. The posterior portion of the paracentral and the quadrate lobe have been obliterated. The upper part of the ascending frontal has been pressed upon severely. The meninges showed a diffuse sero-purulent meningitis, due to streptococcus infection. Location of tumor destroying the quadrate and posterior part of paracentral lobule, and pressing upon ascending parietal convolution, gave only as an indication the disturbance in sensation, and the astereognosis which were only slight, and were not considered marked enough for diagnostic purposes. Had the same incision been made upon the opposite side, it would have exposed the tumor, but the infection of the wound after operation precluded it. See Plates XVII and XVIII.

This tumor does not compress the cuneus nor the cerebellum, and therefore produces no symptoms referable to the cerebellum or the cuneus. (Oppenheim, "Traité," p. 125.) Oppenheim reports a case in which this was the condition. The only marked symptom in our case was the hallucinations, while the less marked symptoms were the slight disturbance in tactile sensations and the apraxia on the left arm and leg.

We have consequently, in the lateral region of the skull, 17 cases, 2 deaths, 7 slightly improved or unimproved, 8 cases cured,—that is, remaining well after one or more years.

Of the 13 cases of which we have no records following the operation, our mortality, due apparently to or at least superinduced by the operation, was 15 per cent (2 cases). Our combined operative mortality in this region is then 13.3 per cent.

In the occipital region the area to be exposed in each instance is that including the cuneus, and the first, second and third convolutions; that is, all the portion of the cerebrum behind the middle of the superior and inferior parietal convolutions. This flap will therefore include the space between the point of meeting of the Sylvian line and the sagittal suture above, the temporo-sinusal line below, the sagittal suture in the median line, and a point one finger's breadth above the posterior root of the zygoma in the temporal fossa.

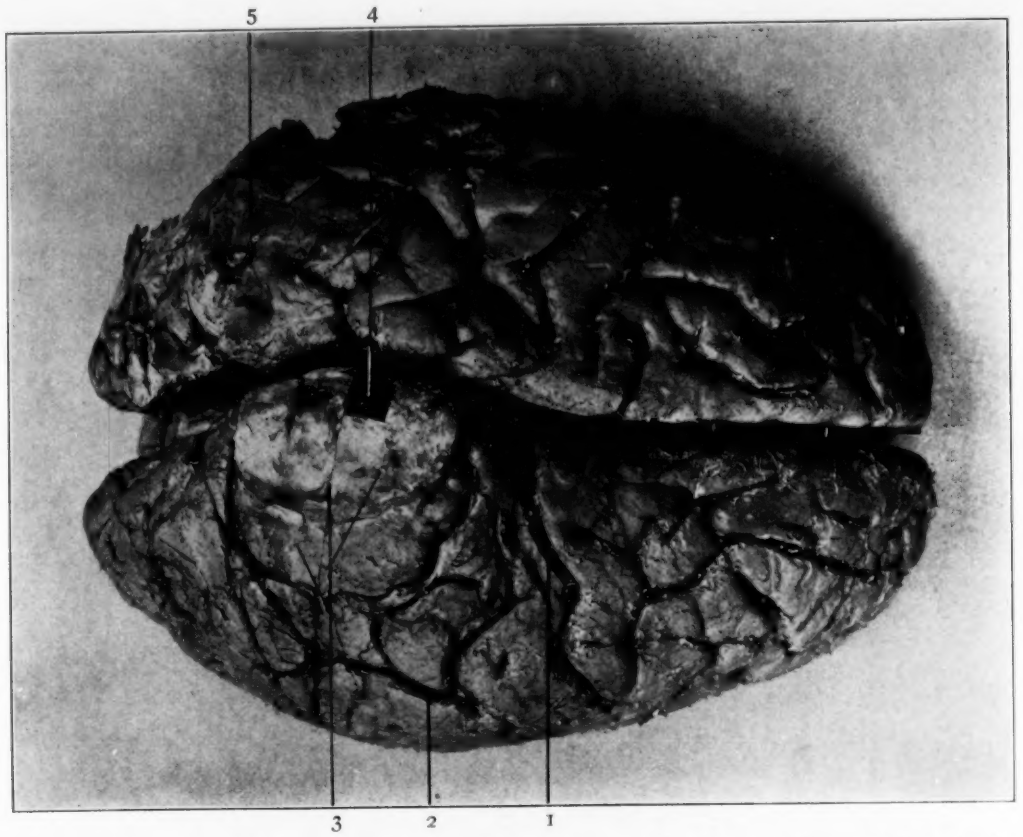

PLATE XVII.—Case XXV. Endothelioma. 1. Rolandic fissure. 2. Sylvian fissure. 3. Tumor and line of section of tumor shown in Plate XVIII. 4. Section taken from tumor for pathological examination. 5. Site of operation.

PLATE XVIII.—Case XXV. Endothelioma. 1. Site of operation. 2. Parieto-occipital fissure. 3. Tumor. 4. Sylvian fissure. 2, 3 and 4 show the transverse section of the tumor and brain at the point shown by Fig. 3 in Plate XVII

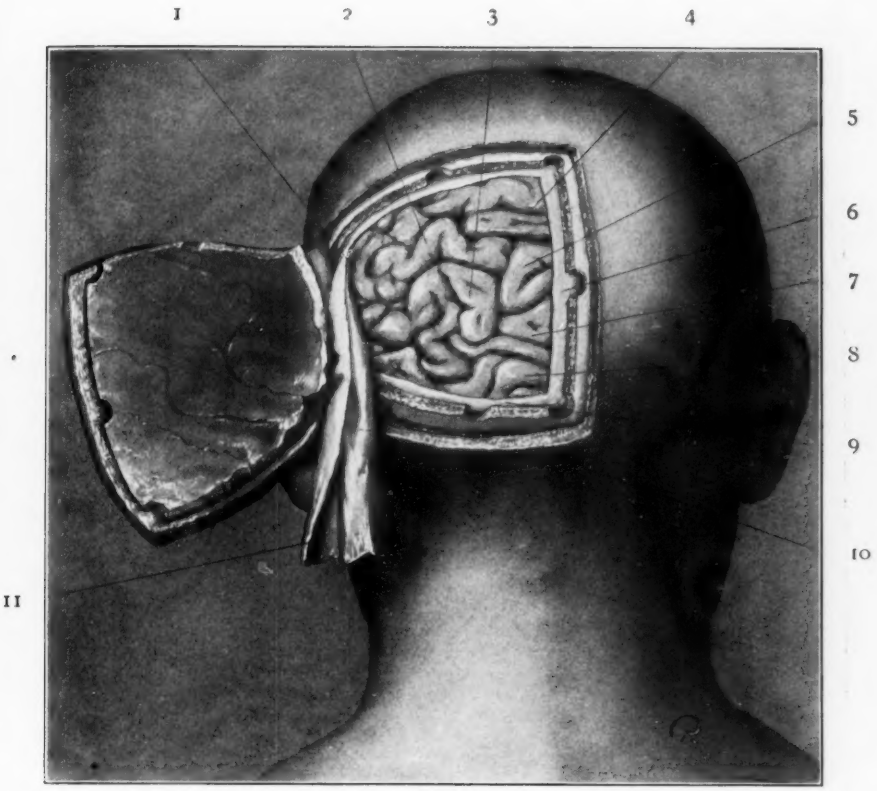

PLATE XIX.—1. Supramarginal convolution. 2. Inferior parietal convolution. 3. Angular convolution. 4. External parieto-occipital fissure. 5. First occipital convolution. 6. Superior longitudinal sinus. 7. Second occipital convolution. 8. Third occipital convolution. 9. Lateral sinus. 10. External occipital protuberance. 11. Dural flap.

In this region of the skull exposed by this flap, we have one case.

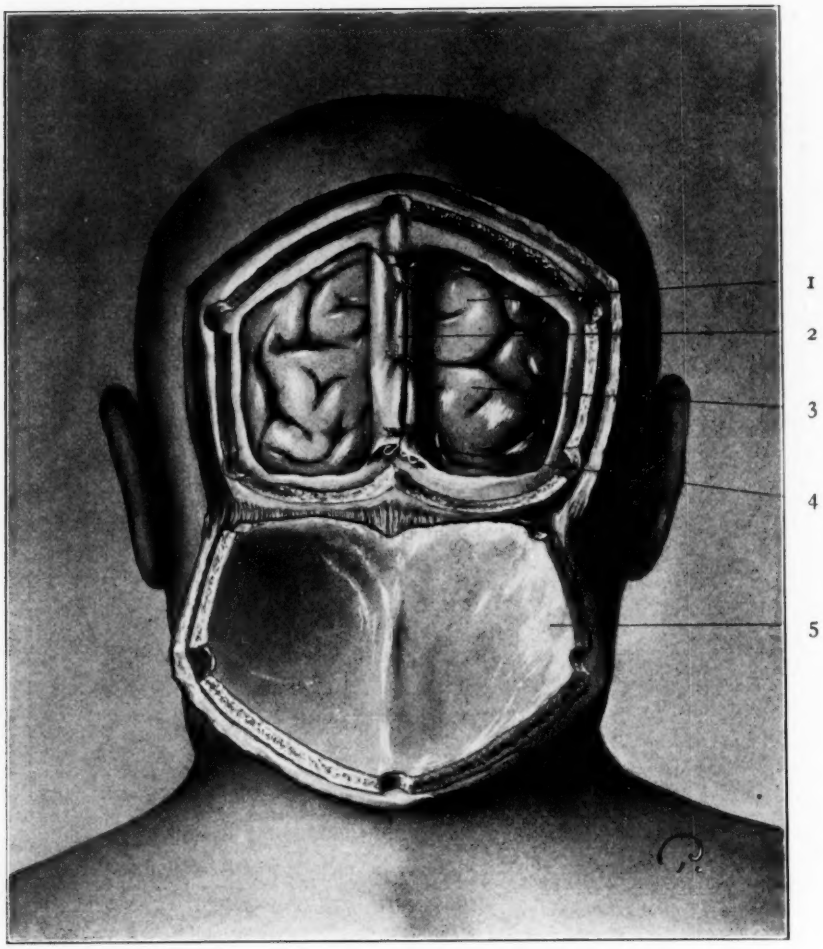

PLATE XX.—1. Superior occipital convolution. 2. Dural flaps. 3. Second occipital convolution. 4. Third occipital convolution. 5. Reflected bone flap.

This form of flap is (see Plate XIX), in our opinion, the best because it exposes the cuneus and lingual lobes, and permits a view of the inferior parietal and angular convolutions, and it may be extended forward at its base if there be any need of exposing the convolutions along the Sylvian fissure. Its blood supply is from the temporal artery, and is good. The bone breaks in the thinnest portion, and the thicker parts of the skull are now divided with the saw. The shape and extent of the flap may be sawn and broken as one wishes, without the danger of having it break at some undesired portion, with the consequent prolongation of the operation, and the increase of shock.

Our incision commences at the temporo-sinusal line in the temporal fossa, near the posterior root of the zygoma above the external meatus. It passes to a point 1 cm. laterally from the median line, parallel to and above the temporo-sinusal line. Here it ascends 1 cm. above the Sylvian line, whence it turns and follows this line until the temporal ridge is passed and the squamous portion of the temporal bone is exposed. The first incision in this flap divides the occipital arteries and they require securing. The second incision requires a ligation of the vessels from the opposite side. The anterior incision comes in contact with the temporal arteries. The hæmorrhage must be secured first, because in this portion of the scalp the vessels are large and bleed to a large extent. For this reason we usually use a tourniquet and often the buttonhole stitch (or the metal plates of Kredel). We usually make seven holes in all: two in the temporal fossa at the beginning and end of the incisions; one each half way toward the median line in the upper and lower incisions; finally, two at the extremities of the first and third incisions, near the median line. After drilling and sawing, the flap is raised. It usually breaks in the temporal fossa, opposite the junction of the posterior and middle third of the Sylvian fissure, so that a perfect exposure of this region is obtained. The posterior branch of the meningeal artery is exposed in the lower angle, and above it upon the upper surface of the dura mater one or two vessels may be

seen, passing into the longitudinal and transverse sinuses. These, however, are not difficult to secure. The dura is usually incised in the line with the bone flap, and with the base towards the temporal fossa. It may have its base in the opposite direction, if one wishes, though we prefer the base to correspond with the base of the bone flap. When reflected there is exposed the posterior portion of the superior parietal, a part of the supramarginal, the whole of the angular gyrus, and the three occipital convolutions. By retraction outward of the brain, the præcuneus, cuneus and part of the lingual lobe may be seen. The enucleation of a growth in this region by this incision would not be difficult, provided it did not involve the lingual lobe where, if it were small, it might easily escape observation; while in the other lobes the same growth may be more easily identified and enucleated. Such a case as this has been recently operated upon in two stages, by Krause, assisted by Oppenheim, and an account of which is given in the *Berliner Klinische Wochenschrift,* Dec. 17, 1906.

The patient was a man of thirty-five years, who, after suffering for some weeks from headache, developed right-sided hemianopsia, optic neuritis of the right eye, vertigo, vomiting, bilateral choked disc most pronounced on the right side, and partial alexia and agraphia. A little later right-sided hemihyperæsthesia, hemiataxia, and hemiparesis developed. It was believed that from the clinical signs the tumor could be located in the occipital region of the left side, and operation was decided upon and performed in two stages three and a half months after the onset of the headache. At the first stage a large quadrilateral bone flap was made over the occipital lobe, exposing the lateral and longitudinal sinuses. Sixteen days later the wound was reopened and the dura incised. The tumor could be immediately seen occupying the lower median angle of the opening made, and it was easily removed by blunt dissection. It measured 32 x 55 x 58 mm., and was egg-shaped. On microscopical examination it was found to be a spindle-celled sarcoma. The second operation lasted only one-half hour and there was little loss of blood, but during several days the patient was in a very precarious condition owing to high temperature and rapid and feeble heart action. He ultimately recovered completely, the only symptoms persisting being a moderate contraction of the right visual field, while otherwise he is entirely free from difficulties.

Case XXVI.—R. M. May 23, 1906; discharged June 3, 1906. Twenty-one; single. *General symptoms*: Day before

admission struck on head with a bale hook. No loss of consciousness. Small punctured wound, 1 cm. long, from which brain matter escapes. Wound enlarged and puncture into brain found. Vomited occasionally; eyeball moves in every direction. Pupils react to light and accommodation, equal, moderately dilated. Homonymous hemianopsia. Four hours after admission became somewhat dull, and complained of headache (frontal). Pulse irregular, slow. Increased tension. *Localizing symptoms:* Homonymous hemianopsia. Injury to skull. *Diagnosis and localization:* Diagnosis, punctured wound of the angular convolution(?) (lobule de pli courbe). *Operation:* Rectangular osteoplastic flap, with base in temporal fossa above the mastoid (burr, drills and saw). Flap raised, exposing the under surface of bone and showing the tearing away of the inner table 2.5 x 2 cm., while the hole was .5 cm. in diameter. Dura torn and lacerated, admitting the finger. Brain lacerated over the angular gyrus and for a depth of 1 inch (2.5 to 3 cm.) The three occipital lobes, the external parieto-occipital fissure and the supramarginal convolution were recognized. The puncture was between these points. Clot removed. Area covered with Cargyle membrane, drainage with gauze. About one-half the bone was removed to facilitate the drainage. Dura sutured. *Result:* May 28, wound closed. Hemianopsia almost gone. June 3, hemianopsia gone.

This case seems to show that a lesion situated cortically at the junction of the occipital, the angular and the inferior parietal lobes, extending 2.5 to 3 cm. in depth, will produce a bilateral hemianopsia, of which the patient was not conscious until his attention was called to it. Then he appreciated distinctly that his field of vision in each eye was limited to the same side as the lesion. The optic radiations of Gratiolet were probably involved.

If both sides of the occipital region are to be exposed at once, it seems to us less of an operation to make a flap including the occipital region below the Sylvian line of each side, with the base at the two temporo-sinusal lines. This form of flap will not make such an advantageous opening for either side; but if both sides must be exposed at once, it seems to offer an advantage over the two separate side openings, in that

there is less drilling and sawing required and consequently less hæmorrhage to be overcome, but the exposure is not so advantageous as is that obtained by the two lateral occipital flaps. Our incisions for the single occipital flap exposing both sides pass upon each side from the junction of the outer and middle thirds of the superior curved line upward and slightly outward to the Sylvian line, at which point they follow this line to the median line, where they meet,—that is, at a point 70 per cent. of the distance from the nasion to the inion. These incisions are carried directly to the bone, the arteries ligated, and the hæmorrhage checked as in all other operations. The drill holes are placed as follows: one on each side, .5 cm. above the tempero-sinusal line, one on each side of the angle of the incision over the Sylvian line, and one on each side of the median line. The saw is used and the bone is broken at the tempero-sinusal line, parallel to the transverse sinuses. The hæmorrhage from the transverse and longitudinal sinuses may be brisk, but it usually may be stopped by pressure or suture with Mata's needles, which I have threaded and ready for use. The dural flaps have their bases at the longitudinal sinus and are reflected over it. The parts exposed are similar to those exposed by the lateral occipital flaps, but not so thoroughly.

Case XXVII.—O. O. New York Hospital, April 21, 1906; discharged May 14, 1906. Male; twenty-one. *General symptoms:* Fell great distance, striking head; was unconscious fifteen minutes. Is stupid, answers questions, but cerebration is slow. Movements of eyeball perfect, pupils react sharply. Is totally blind. No paralysis nor anæsthesia in face, arm or leg. Grip in hands good. Legs contracted with power. Knee jerk not exaggerated. Depression in skull opposite centre of the occipito-parietal suture, with scalp wound 2 inches long. Pulse slow, 60–70; temperature 99.6°; respiration 16–24. *Localizing symptoms*: Total blindness. Depressed fracture over occipital region. *Diagnosis and localization*: Pressure upon occipital lobes both sides by bone and hæmorrhage. *Operation*: Large flap including periosteum formed 8 x 7 cm., exposing the depressed bone, 7 x 7, and circumventing the three occipital

convolutions upon both sides, (*i.e.*) from the Sylvian line above to the temporo-sinusal line below. Bone reincised. Lines of fracture extended to right side toward foramen magnum, loosening the greater part of the occipital bone on that side. Dura injured only over small area. Large subdural hæmorrhage, extending over the occipital lobe and into the longitudinal fissure to the tentorium cerebelli. Dura incised on both sides of longitudinal sinus and clot allowed to escape. Dura sutured and a celluloid plate (7 x 7) moulded to approximate the curvature of the skull. *Result*: April 23, 1906, distinguishes light and darkness. April 24, sees objects moving before eyes. April 25, counts fingers before eyes. April 27, recognizes faces. April 29, can see 50 feet, printed matter with letters 1 inch high. May 14, sight perfect.

If not contraindicated, we prefer after the exposure of one side of this region to add to our lateral flap a similar, though not so extensive flap, upon the opposite side. The hæmorrhage and the sawing necessary to accomplish this may be a little more than is required for the single flap, but it is our opinion that the exposure obtained is worth the risk run and the time expended in making the flap, for the operation may be done under these conditions, in two stages rather than in a single-stage operation.

Such a flap is represented in Plate XXI.

The last two cases, and which were situated upon the occipital region, are important in that they show the necessity of early operation in order to secure rapid recovery and perfect functional restoration. In both of these cases the subsequent perfect restoration was due undoubtedly to the early operation, avoiding the possibility of sepsis, and allowing complete restoration of the brain tissue by the removal of the clot in its substance.

In addition to these cases already reported, we have two more, situated in other regions of the brain, but nevertheless interesting. The first of these cases is the following:

CASE XXVIII.—*Cystic Glioma, filling Third Ventricle and projecting at the Base between the Crura.*—Admitted February 5, 1905, to the New York Hospital, Medical Division (Dr. Loomis). Transferred February 19 to the Surgical Division. Female, eighteen. *General symptoms* (December 4 to 24, 1904): Treated for anæmia and amenorrhœa. Sharp pain in both temporal regions and top of head, followed by unconsciousness, sixteen months ago. Several similar attacks since then. They occur now three times a week and will last often three hours. For the last six months numbness, tingling in hands, arm and feet. Gait unsteady; staggers to both right and left side. During the attacks there is marked projectile vomiting and involuntary urination. No double vision; strabismus. Always has been hard of hearing. *Localizing symptoms*: Eyes: Pupils small, react slightly to light and accommodation. Right optic, disc swollen, central depression lost, margins ill defined, arteries small. Left optic, disc shows the same changes but less marked. Extremities: knee jerks exaggerated; no œdema; no ataxia. Slight Romberg. Staggers more to the right. Ocular muscles are normal. Tongue deviates to the right. Eleven days before she died became totally blind in right eye; vision left eye limited to 5 feet. Exophthalmos gradually became worse. Slight general convulsions appeared. Leucocytes 14,000; temperature 99–100; pulse 96–112; respiration 18–24. General hyperæsthesia. Six days before death eyes became fixed and turned toward left; pupils contracted and inactive. Muscles of right arm and leg spastic; muscles of left arm and leg flaccid. *Diagnosis and location*: Cerebral tumor, localized to right side of pons varolii. *Operation*: No operation. *Result*: Died February 21, 1905, in convulsions.

Histological Examination.—Cystic glioma with hæmorrhage.

Pathological Report.—Base of brain: The tumor with a thickened capsule forms a nodular projection at the base of the brain in the space formed by the crura cerebri and optic tracts. It folds backward over the anterior commissure, to which it is attached. Measures ¾ x 1½ inches. The anterior half of the pons is indented by the growth, but the stumps of the fifth nerve are free and unattached. The third nerves emerge from the crura beneath the growth and are apparently not atrophied; the optic nerves are smaller than normal; the cranial nerves of the medulla are negative; the arteries of the circle of Willis are normal.

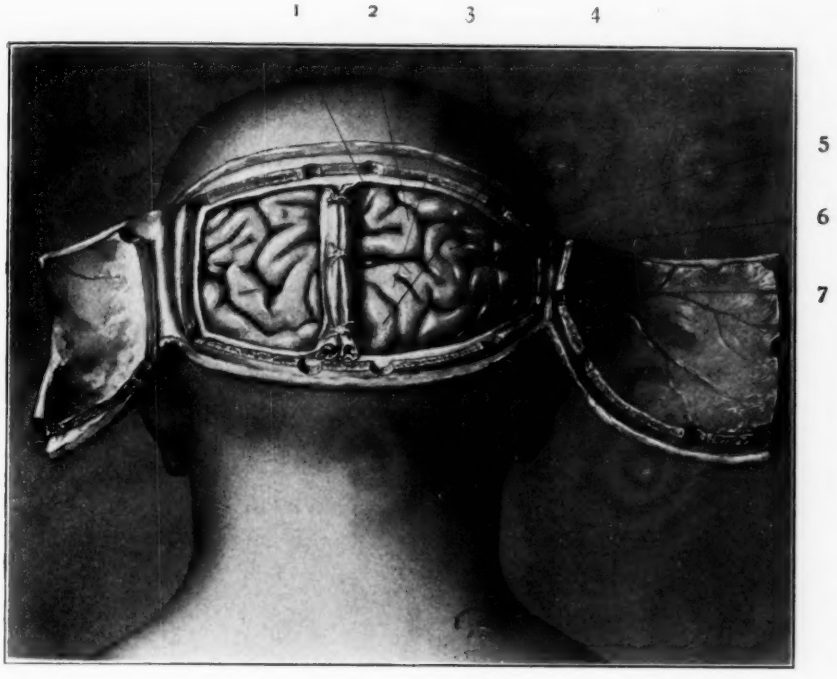

PLATE XXI.—1. External parieto-occipital fissure. 2. First occipital convolution. 3. Second occipital convolution. 4. Third occipital convolution. 5. Angular convolution. 6. Supramarginal convolution. 7. First temporo-sphenoidal convolution.

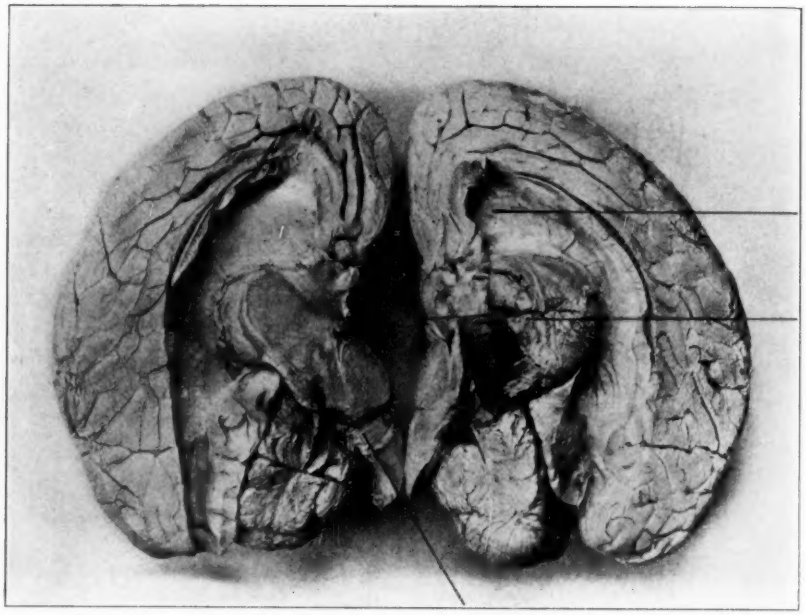

PLATE XXII.—Case XXIX, Glioma. 1. Lateral ventricle. 2. Tumor with hæmorrhagic area. 3. Pons and medulla from which a section has been removed for examination.

Interior of brain: There is a high degree of hydrocephalus; all horns of the lateral ventricle are enormously dilated; the cavity of the third ventricle is completely filled up with tumor mass which rises on either side in the foramina of Munro as whitish eminences. The surface of the growth is smooth and encapsulated. Posteriorly, the growth has compressed the corpora quadrigemina and adjacent portions of the cerebellum. Transverse section through junction anterior and middle thirds of third ventricle reveals a cystic mass with hæmorrhagic areas between the optic thalami. At the circumference there is a margin of whitish translucent tumor tissue sharply circumscribed and more or less encapsulated. The pineal gland and hypophysis cerebri are not distinguishable in the tumor mass. Transverse sections through pons and medulla show only pressure—no infiltration.

"The tumor itself was inoperable, but a decompression would certainly have been of service."—J. Ramsey Hunt.

This case is very similar to one reported by Grenet, except that in his case the pituitary body was not involved by the tumor. (Société Anatomique, 1898, p. 90.) Many cases presenting in the optopeduncular space, are also mentioned by the same author.

Case XXIX.—Admitted New York Hospital, December 12, 1904. Died December 14, 1904. Male, seventeen. *General symptoms:* About one month ago began to have pain and stiffness in muscles back of neck, also frontal headache. These symptoms have gradually become worse. Two weeks ago staggering gait, vomiting and dimness of vision appeared. Is becoming more and more drowsy, is in a stupid condition most of the time. Duration of observation, six weeks. Dr. A. L. Fisk. *Localizing symptoms:* Optic neuritis both eyes, more marked in left in which it started. Partial blindness, drowsiness. *Diagnosis and localization*: Cerebral hypertension from tumor(?). *Operation:* December 13, 1904. Chloroform; scalp and periosteum turned down from left superior curved line, exposing occipital bone. A burr opening was made in this region and enlarged with rongeurs. Cerebellum bulged ¾ inch, little pulsation. Explored with needle and finger, nothing found; needle

then inserted upward through tentorium, also negative. Scalp returned and sutured, rubber tissue drain. Small burr opening then made in occipital bone, opposite side (right side). Cerebellum did not bulge. Needle inserted, nothing found. Scalp returned and sutured. *Result*: Died.

Autopsy.—The opening in right occipital bone is 1.5 cm. in diameter and is in the centre of the right posterior fossa. The opening in the left occipital bone is about twice as large and its upper border corresponds to the lower edge of the lateral sinus. The dura has been opened and softened cerebellar tissue protrudes slightly. The meninges are normal. The cerebral convolutions are everywhere moderately flattened without any appreciable difference in degree in any region. The lateral ventricles are moderately enlarged and contain an excess of serous fluid. Owing to the presence of a soft, partly gelatinous tumor, which is limited to this ganglion, the right optic thalamus measures 5.5 cm. anteroposteriorly, 3.5 cm. transversely, and 3 cm. vertically. There is marked flattening of the inner surface of the left optic thalamus, owing to pressure by the tumor. The posterior and inner part of the growth is the seat of hæmorrhage and the capsule has been ruptured, allowing the gelatinous tumor tissue to escape and partially fill the fourth ventricle. Whether this rupture occurred during removal of the brain or prior to this cannot be stated. Microscopical examination shows the tumor to be a very cellular glioma. The cells are of the small type. There is an abundant vascular supply and the vessels as a rule have very thin walls in proportion to their size. There are small areas of necrosis scattered through the growth.

Though the tumor was a large one and involved the optic thalamus, the symptoms were only those of cerebral hypertension.

POSSIBILITIES AND LIMITATIONS OF BRAIN SURGERY, WITH ESPECIAL VIEW TO TRAUMATISMS.*

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BRAIN surgery is still in the hands of the general surgeon, assisted in diagnosis frequently by the neurologist, and while not in itself a specialty, calls, perhaps, for more special knowledge and skill than any other branch of general surgery. From the close anatomical proximity of the organs of special sense to the brain and the relation of their different pathologies to various brain lesions, the eye, ear, and nose specialists, in particular, find their operative work often concerned with the brain and its envelopes, and consequently must be familiar with the principles and technique of this subject. They should also be able to dissect the triangles of the neck in case of sinus thrombosis.

Brain surgery necessarily includes that of its bony capsule, the cranium, as well as its membranous and vascular envelopes, the meninges. The necessity for such surgery is essentially threefold: 1. The presence of new growths, either of the viscus itself, or its envelopes, constituting the elective class; 2. The various results of trauma, such as fractures, accompanied or followed by depressed bone, hæmorrhage (later cysts) and abscess or meningitis resulting from direct infection; 3. Metastatic processes from septic conditions in the skull or adjacent bony sinuses—the last two making up the emergent class.

In a general way the difficulties or limitations are: 1. The relative difficulty of access to this viscus compared with that of reaching the various organs and viscera in the three other chief

* Read before the Practitioners' Club of Jersey City, December 4, 1906.

cavities of the human body; 2. The great desirability, if not necessity, and the frequent difficulty, if not impossibility, of a precise pre-operative geographical diagnosis. In the thorax, abdomen and pelvis explorative operations are feasible without a pre-operative diagnosis, while within the skull they have usually been considered prohibitive, or at least of very doubtful expediency; 3. The fact, closely allied with the one just stated, that symptoms of brain lesions are not infrequently delayed, and even when manifest are often misleading, coupled with the other fact, that lesions in the so-called " silent regions " of the cerebrum, viz., the first and second frontal convolutions with most of the occipital region, generally give us no leading symptoms.

The possibilities of improvement in brain surgery lie chiefly in a clearer knowledge of regional function, and its interpretation by symptoms—in other words, better diagnosis. For instance, Krause, of Berlin, by the use of local faradization, while exciting cortical centres in the human brain, in operations for Jacksonian epilepsy, has taught us that the motor area occupies not the ascending frontal and parietal convolutions, but the ascending frontal only; while the speech centre, instead of being single and located in Broca's convolution, is threefold, with as many anatomical distributions. Increasing use is also made of the ophthalmoscope to determine eye conditions having some bearing on brain lesions.

The work of Keen and Sir Victor Horsley have shown the possibility and expedience of removing or breaking back large bone areas for explorative purposes, when diagnosis is presumptive but not positive.

The tolerance of the brain itself to aseptic explorative puncture, incision, etc., is increasingly apparent.

In exploring for brain abscess the best instrument is the dull spatula-like knife of Horsley, which on being introduced and pressed slightly one way and the other allows more ready outflow of pus, where it exists, than does a director.

If pus appears, never withdraw the knife or director until a pair of forceps is passed down to the cavity and spread sufficiently to allow evacuation and subsequent passage of a drain.

preferably a soft rubber tube or rubber tissue, as gauze does not drain pus but rather causes retention. If the exploring instrument be withdrawn before introducing a spreading forceps the location of an abscess may easily be lost, as the soft brain matter rolls in and obscures the explorative track.

The usual order of symptoms of brain abscess are headache, somnolence, deepening into stupor, slow pulse and moderate temperature variations, usually preceded by trauma of skull or disease of one of the bony sinuses. The headache, however, may be very transient, or the patient may be first seen in the stage of somnolence or coma, when the case may be confused with uræmia, continued fever, alcoholism, etc. The pulse may be rapid instead of slow and the temperature may run high.

Meningitis may be compared in the cranial cavity to extensive peritonitis in the peritoneal cavity, but offers less hopeful outlook to operative treatment, although drainage is sometimes, though rarely, successfully attempted.

Disease or injury in the motor areas offer the best opportunity for operative treatment when consciousness is not lost; but the surgeon should not forget that abscess or tumor in the "silent regions" may, by transmitted pressure, simulate motor area conditions, and so mislead attempts at geographical diagnosis. It may be noted, in passing, that lesions of the frontal lobe are not infrequently followed at a later period by changes of temperament or disposition.

Many have been the interpretations of pupillary changes, but it is now pretty generally held that while contraction, dilatation, inequality, etc., occur as the result of brain lesions we know practically nothing about the exact relationships. It probably is safe to assume this much, that a persistently irresponsive pupil indicates cerebral trouble.

Choked disc or "high-grade optic neuritis" is not a sign of much value in emergent or traumatic brain surgery, as it rarely exists in intracranial hæmorrhage or brain abscess. It is most characteristic of brain tumors.

Cheyne-Stokes breathing is a concomitant of the late

stages of meningitis, being generally a precursor of death. Its cause is in dispute, but is probably due to alternating anæmia of the respiratory centre in the medulla.

In traumatic conditions of the brain, consciousness or unconsciousness, pulse rate, tension and temperature, and of course localizing symptoms, if conscious, are the most important factors in determining diagnosis, prognosis and plan of treatment. Of all these the temperature course is probably the best index of the severity of the lesion. It is considered important in unconscious cases to know whether or not there was even a brief interval of a few minutes or seconds of consciousness before stupor or coma began. It is pretty well recognized to-day, however, that long continuance of unconsciousness means either extensive pressure by depressed bone or blood clot, or else brain contusion. The form of contusion under consideration is really an organic injury of serious import, owing to disintegration of brain cells and consequent cerebral œdema, not dependent on pressure, and consequently not amenable to treatment by trephining, incision of dura, etc.

This water-logged condition, dependent on loss of cell vitality, is often overlooked, even at autopsy, unless accompanied by excess of serum in the ventricles and arachnoid space, but is none the less, when it exists, an almost invariable cause of death. We suspect this serious form of œdema in cases of prolonged stupor, rising and, *later*, irregular temperature, and should recognize the futility of operation for relief of presumed intracranial tension which either does not exist or else is incapable of relief, because the tension-producing element is not superficial, but intimately distributed throughout the brain substance.

Case I.—A. V., aged ten months, fell a distance of about 8 feet—immediately unconscious. Two hours later I saw the child in consultation. Shock was profound; convulsions involving both right extremities, and afterwards the left as well; pupils somewhat unequal; pulse barely perceptible; surface cold and clammy. I declined to operate because of general condition and

ignorance of the locality of lesion on account of the general and multiple symptoms. A tentative diagnosis of cerebral hæmorrhage with extensive clot formation, or, more probably, serious general contusion, was made. For many days the infant hovered between life and death, afterward developing spastic contractures of all extremities, and finally passed from my observation because of my absence from the city. At a period of about six weeks after the injury Dr. Starr saw the case and diagnosed cerebral hæmorrhage with clot formation, focal intensity over left motor region. A rapid trephining, with nearly a fatal termination, on the table was done, with escape of about 2 fluid drachms of serum, followed by disappearance of spastic contractions, the patient dying, however, five days later. This relief of spasm must be considered in the nature of a triumph for surgical intervention in spite of almost insuperable limitations and the final fatal result.

1. The question arises whether the infant's general condition would, at any time, have permitted successful (curative) operation. In my opinion it is very doubtful. 2. Diagnosis—A blood clot sufficiently large to cause such extensive and manifold symptoms should have resulted in a larger quantity of serum at operation. The theory of general contusion within involvement of vitality of a multitude of cells seems more probable, as it would account for the profound shock and numerous symptoms, without a large amount of free serum. In such a case operation at any time must have failed.

CASE II.—T. H., aged twenty-five, alighted, at night, carelessly from a moving train; fell and sustained a scalp wound in the upper part of the forehead near the median line. A local physician decided that there was no injury to skull or brain and sewed up the wound which healed kindly. About two months afterwards the patient became erratic, complained of frontal headache and rapidly developed mania; family history on this point negative. Patient was an inmate of private sanitorium for mental diseases for about two years without improving. The family, then, on advice, consulted Dr. W. W. Keen of Philadelphia, who diagnosed probable fracture at site of injury with cyst due to hæmorrhage. Operation completely verified the diagnosis by the escape of more

than an ounce of serum through the trephine opening, and full recovery of reason.

1. It is probable that immediate explorative incision of the scalp in the region of injury would have revealed a fracture, even though not depressed, and that trephining would have discovered hæmorrhage and permitted its control—thus saving this talented young man two years incarceration is an asylum. 2. Note the possibility of cure in such cases of hæmorrhage by removal of the pressure element as late as two years, with the probability of a still later limit.

CASE III.—J. McM., aged twenty-seven; admitted to the City Hospital July 3, 1904, suffering with what was diagnosed by the interne staff as a simple scalp wound on the left side of forehead near hair line, produced by a blunt instrument; length of wound ⅝ of an inch. No involvement of bone discovered. An explorative scalp incision not made; wound closed by suture and patient returned to his home. Two days later sutures were removed at the out-patient department of the hospital; union apparently good.

Two weeks later he returned to the dispensary on account of a small abscess in the suture line, which was evacuated and for about ten days dressed in the out-patient department. Meanwhile, no other symptoms developed.

July 30, an ambulance call was sent in for this patient, and he was removed to the hospital, where he remained until his death.

His history, on admission, presented nothing of note until 11 A.M. of that day, when he became moody and refused to talk, in spite of which he ate a hearty dinner. After dinner he went to bed and slept until 6 P.M. On waking he would only mutter incoherently; his gait was unsteady. Upon arrival at hospital his mentality was somewhat better; gave an account of his injury and identified his assailant.

Next morning (July 31) when questioned, he always gave the same answer, namely: "424 Montgomery street"—his residence; some loss of power in right arm; in afternoon dragged right leg. Next day (August 1) right arm and leg completely paralyzed, together with right facial paralysis; choked disc in

right eye; left eye normal; sensation normal. At this time his answer to all questions was "McManus"—his name.

Diagnosis, cerebral abscess in left motor area. Operation advised but refused by relatives, who later, however, consented. Operation performed August 5; patient's condition stuporous, temperature 99.2°; pulse 84; respiration 24.

Usual scalp and bone incisions were made over the line of the fissure of Rolando, the bony opening measuring 2 inches by 1½. The brain pulsated; the dura appeared normal, and without tension. Our belief in the existence of an abscess, however, was so strong that the dura was incised and the brain substance in the underlying motor area explored in various directions by means of a good sized director. No pus found. Much to our surprise, however, on the following day the paralysis disappeared, showing that the operation had relieved tension that had not been appreciable to either sight or touch.

Improvement continued for about one week when paralysis and aphasia returned in the same order as on their first appearance. The general condition, meanwhile, became alarming. It then occurred to me to trephine over the site of injury, in spite of all symptoms pointing to the motor region. The patient's low general condition and the fact that his death would transform the case into one of murder, made me hesitate lest the defense would charge the result on the surgeon instead of the assailant. However, I reopened the wound without anæsthesia, and again used the director without result. Then I decided to take the desperate risk of trephining over the point of injury, ordering preparations for the following morning, but death intervened at 5 A.M.

Autopsy showed no appreciable fracture of the skull, but a small area of adhesion between the dura and cranium, about the size of a silver dime, just beneath the site of injury, also a corresponding adhesion between the meninges and cortex. The convolutions in this neighborhood were prominent, and on incision an abscess containing about 2 ounces of pus was revealed. The abscess was entirely in the frontal lobe but extended well backward and downward toward the motor area. There was evidence of a recent small abscess under the scar of the original scalp wound, a thin layer of purulent material intervening between the scalp and skull.

1. In spite of the non-existence of macroscopic fracture or even fissure, there was in this case transmitted infection, possibly by an emissary vein.

2. Evidence of brain pressure at some interval after skull traumatism is ground for suspecting brain abscess.

3. Pronounced motor symptoms do not necessarily mean that the lesion is in the motor area; they may mean transmitted pressure.

4. A marked peculiarity was that the aphasia was not motor, for he articulated words, but was nearly completely amnesic, for he only remembered his name and address, yet the centres for memory of words and objects are farther from the lesion in this case than the centre for motor aphasia, which exists in the posterior part of the third frontal convolution, the others being in or near the angular gyrus. This must be explained probably by the existence of the association fibres and their probable implication.

5. The presence of brain pulsation and absence of appreciable tension are not always reliable evidence of the absence of abscess or tumor.

6. The choked disc and facial paralysis, as well as the arm and leg paralysis, were on the side of the body opposite to the lesion—a rare occurrence. This may be explained by the action of the commissurial fibres.

7. The chief lesson of this case is that paralysis or hemiplegia in a septic traumatic case may mislead one into operating over the motor area, where no lesion may be found. Conversely, always trephine under such circumstances immediately at the site of injury, as the whole trouble may be there.

CASE IV.—T. S., aged forty-eight, transferred to City Hospital from another hospital. He was suffering from alcoholism together with a scalp wound over the right parietal eminence. The wound had turned up a more or less semi-lunar flap, including periosteum, leaving bare a bone surface approximately the size of a silver half dollar.

The patient had been several days in the hospital from which

he had been transferred, and the sutures (if any had been introduced) had either been removed or had cut themselves out, leaving the forementioned exposure of the skull. Examination of this bare area showed no irregularity or sign of injury, unless a mere hair line without depression could be interpreted as a fissure. There was no paralysis and no disturbance of mentality, except such periods of mild restlessness and excitement as are common to alcoholism, for which condition he was placed under treatment. The scalp wound was cleaned up and an antiseptic dressing applied.

This condition lasted about a week, at the end of which time I was absent from the city for a few days. On my return I found that the patient had died. He had suddenly developed left-sided twitchings, rapidly followed by paralysis, on the appearance of which my house surgeon had immediately trephined over the hair-like line on his skull, finding an abscess containing about one ounce of pus. The patient rapidly grew worse and died about forty-eight hours after operation.

Autopsy revealed an abscess cavity under the exposed bone, and also a quite extensive suppurative meningitis, involving the surrounding convolutions.

1. One should always question every suspicious mark on an exposed skull surface in case of traumatism, even if it be no more than a hair line, for this may be a possible fissure and a potential source of infection.

2. Do not pass lightly any evidence of disturbed mentality, such as alcoholism, in the presence of skull traumatism; it may mean either meningitis or abscess; and remember that alcoholism, *per se*, has a sub-normal temperature, while meningitis and brain abscess show temperature elevation.

CASE V.—John A., aged twenty-nine; arrested October 29, 1906, and locked up at the station house as drunk and disorderly. He complained of headache during the night, and was found unconscious in his cell the next morning. Sent to the City Hospital.

Conditions on Admission.—Unconscious; temperature 99°, rectal, pulse very high tension, and slow; respiration 16. A super-

ficial brush wound over the left malar bone; a contusion of the right posterior vault of the cranium near parieto-occipital junction, and three dime-sized spots of ecchymosis on the left arm were all the external evidences of injury to be found. Pupils normal and responsive to light; no paralysis, but slight hypertonicity of muscles. Four ounces of urine obtained by catheter, dark amber, highly acid, sp. gr. 1020; sugar, casts and blood, negative; urea not estimated.

Treatment.—Head shaved and ice cap applied; calomel gr. v and jalap gr. xx administered by mouth; croton oil minims ii and olive oil, one pint, given as a high enæma; pilocarpine, gr. 1/10, hypodermatically, repeated in one hour.

Twelve M., temperature 98.8°; pulse 60, tension lessened; respiration 18; skin moist and warm, free action of bowels; pupils still normal; muscle tonus increased.

Two P.M. Patient yet unconscious, passing bright red blood from bowels; specular examination revealed no source of hæmorrhage; enæma of 1½ ounces. Adrenaline, 1/1000, in one pint of cold saline was given and an ice cap applied to the abdomen without effect; also an enæma of 2 ounces of bismuth subnitrate in a pint of cold saline, with negative result.

Six P.M. Muscle tonus minus; hæmorrhage continuing; temperature 99°; pulse 85 and soft; respiration 20.

Hæmorrhages continued and general condition of collapse deepened until death occurred at 1.25 A.M. the day following his admission.

Post-mortem Findings.—External evidences of injury as already noted. On dissecting up the scalp the right temporal muscle was found infiltrated with blood and a line of fracture 4 inches long was revealed, extending from the right parietal eminence downward and forward to the petrous portion of the right temporal bone, without elevation or depression.

Removal of the calvarium exposed a blood clot 3½ inches in diameter and 1 inch thick at its centre (amounting to about 2½ cubic inches), the posterior branch of the middle meningeal artery having been divided where it crossed the line of fracture. A corresponding depression in the cortex, extended from the margin of the posterior ascending parietal convolution to the cuneus and from the base of the skull to a point 1 inch below the longitudinal fissure.

Opening the abdomen the omentum and peritoneum were found dry and the intestines empty. The large intestine contained unclotted blood throughout its whole length, but no point of ulceration or erosion could be found. The mucosa was injected, blood-stained and showed small spots of submucous hæmorrhage. The liver indicated beginning fatty cirrhosis. Spleen normal. The kidneys were of normal size, capsule stripping easily. The cortex was slightly congested but no pathological condition was evident to inspection. Bladder contained about 8 ounces of urine. Heart and lungs normal. No microscopical examination of kidney tissue was made, consequently the possibility of nephritis was not definitely settled.

1. Here was a case where the different elements of a possible brain traumatism of a serious type, uræmia, or simple alcoholism presented upon admission.

2. The coma would be common to all; but at the time of admission. if due to alcoholism, should have been disappearing. In either of the other conditions it would likely be increasing.

3. Pulse rate and tension might be the same in either brain traumatism or uræmia.

4. Scanty secretion of a highly albuminous urine, together with coma and a high tension pulse, were very suggestive of uræmia, which we are not even now certain did not play a part, because no microscopical examination of the kidneys was made owing to lack of suitable facilities at hospital.

5. There was no external evidence of fractured skull.

6. The clot, although over some parts of the motor area, did not give motor symptoms, because of the existing coma.

7. Had a *local* scalp explorative incision been made no fracture would have been discovered.

8. Had an *extensive* scalp exploration been made the fracture would have been discovered. Trephining and control of hæmorrhage would then have transpired.

9. It is still an open question whether or not this procedure would have saved life. The patient evidently bled to death from intestinal hæmorrhage.

10. The vital question is what caused the continuous and fatal hæmorrhage?

11. Undoubtedly increased tension was an etiologic factor; but was the tension due to brain pressure or nephritis, or in either event would the increased tension for twelve to fifteen hours, have caused hæmorrhage in the normal intestinal mucosa?

12. If early operation is desirable to control hæmorrhage due to fracture of the cranial vault, this case certainly demonstrates the value of *wide explorative incisions and dissection of the scalp.*

Inasmuch as the fracture was not depressed but simply linear and did not approach the point of contusion nearer than 2 inches, nothing less than the reflection of a large flap of scalp would have revealed it. Such a procedure, if aseptic, should be safe, and if findings are negative the patient should be none the worse, while if positive much might be gained.

THE VALUE OF TREPHINING AS A PALLIATIVE MEASURE IN TUMORS OF THE BRAIN.*

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Sir Victor Horsley, in his address on Surgery, at the meeting of the British Medical Association in Toronto in August, 1906, drew attention to the importance of trephining for the relief of certain symptoms due to intracranial disease and, as my experience with a small number of cases of this kind would fully bear out the opinions expressed by him, I take this opportunity of further emphasizing this subject.

The classical symptoms of tumor of the brain are: Optic neuritis (which usually ends in total blindness); severe headache; and vomiting,—all of which symptoms, being dependent on pressure, can be relieved or entirely removed by a free opening in the skull and dura mater. The most serious symptom of all is, of course, optic neuritis on account of its resulting in blindness: and if there is any means of averting this dreadful calamity it is our duty to employ it. The most important factor in the production of optic neuritis is increase of intracranial tension, and consequently Horsley found that the optic neuritis rapidly subsided after opening the skull and the dura mater. He says that in no case of optic neuritis (excepting those of toxæmic or anæmic origin) should the process be allowed to continue after it has once been diagnosed, and if blindness results therefrom, the responsibility is very heavy upon any one who fails to advise an opening of the dura. It is desirable that the gravity of this responsibility should be generally recognized.

It is usually necessary to make a free opening in the dura

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mater as well as to remove a portion of bone. As to the prediction of the improvement of vision after such procedure everything will depend on the condition of the discs. Yellowish white patches of exudate or white atrophic changes, especially when associated with macular figures, all indicate that the secondary changes in the discs will be permanent. In proportion to this development will the vision be impaired, whereas when the loss of vision has been dependent on the swelling of the discs, then not only is the sight saved but largely improved. In other words, one might say that where the neuritis had not passed on to atrophy the sight would be saved. Horsley states that the optic neuritis commences on the side of the lesion, so that one should be able to judge the side of the lesion by observing which of the nerves is first affected, or, if both are affected, the one which seems to be suffering the greatest changes. The old procedure of de Wecker, of incising the swollen sheath of the optic nerve in the orbit, is of no avail, but Horsley states emphatically that we can with certainty avert blindness by opening the subdural space early, in cases of intracranial disease.

I shall now give the history of some patients with brain tumors upon whom I have recently operated.

Case I.—Mr. H. C.; age sixty; patient of Dr. Fotheringham. Admitted to the General Hospital September 25, 1906. Complaint: Stupor and muscular weakness of the legs. About two years ago he began to show weakness of the legs and unsteadiness at times. He had a staggering gait to one side—not sure now to which side. Gradually he became bedridden; he was very weak, the legs were paralyzed and his intellect became dull. His condition gradually grew worse until now he is in more or less of a stupor, though he can be roused. His arms are also weak.

Present Condition.—Legs not completely paralyzed; he can move them a very little. Considerable spasticity of legs and arms. No vomiting. Pupils somewhat dilated but equal; double optic neuritis present.

Patient was also seen by Dr. Howland. Diagnosis: Tumor of the brain, thought to be in the right Rolandic area.

October 2.—A piece of the skull over the middle of the right motor area about 3 inches square was removed. The dura was not opened, as it was intended to do the operation in two stages. Patient recovered nicely, and on October 9 the second stage of the operation was proceeded with. The dura was then opened and an exploration made, but no tumor found. There was considerable œdema of the brain substance.

October 12.—Patient gradually became comatose after the operation and died this evening. An autopsy was done and a growth the size of an egg was found in the left lobe of the cerebellum, lying immediately under the pia mater, uncovered by brain substance. On section it was found to be gliosarcoma. The mistake in locating the position of the tumor was probably due to not taking into account the early symptoms, which all pointed to cerebellar tumor. If this case had been diagnosed and operated upon earlier there would have been a good chance of recovery.

CASE II.—Dr. W. T. C.; age forty-eight. Admitted to the Toronto General Hospital August 15, 1906, under the care of Dr. Campbell Meyers. The patient was born in Oxford County and practised medicine in Detroit, Mich., until six weeks ago. Four years ago he felt overworked and gave up practice for a few months. He has been fairly well since, but has felt tired and not up to par. He is a light smoker and uses alcohol sparingly. He has been using a motor car recently but has not felt equal to driving it at night. Never had syphilis or gonorrhœa. He complains of diplopia, pain over the left eye and a feeling of exhaustion. There is no history of nervous disease in the family. About six weeks ago he felt more tired than usual and the pain commenced in his head. He had been treated for unequal pupils. As the pain in his head continued and he felt weak, he went to Cobalt to see some friends and for the change, but the pain in his head became worse—so severe that he could not sleep. He came to Toronto and Dr. Ryerson examined his eyes but could find no cause for the diplopia. Discs were normal.

Present Condition.—He has lost weight lately and looks to be sixty. He is very restless, especially at night, tossing about and moaning and talking. He lies with both eyes shut, but when talking or walking he opens the right eye though never the left unless asked to do so, then very slowly. He is hard to rouse and requires a good deal of shaking to get him up. He walks uncertainly

unless guided, sometimes with the right eye open and sometimes with both closed. It is very hard to get him to talk and he answers questions slowly and in monosyllables and seldom gives a direct answer. He wanders a great deal and apparently cannot concentrate his mind to answer questions put to him. Cerebration is slow. He takes no interest in things going on around him. The pain, he complains, is very intense, being behind and above the left eye; it is worse at night and he has been unable to sleep for nights without morphia. The left pupil is a little dilated and a little larger than the right; both react to light and accommodation for distance. Sight is fairly good in the left eye but not as good as in the right.

On August 24 he was examined by Dr. Putnam of Boston. On this date his superficial reflexes on the left side were abolished, his left Babinski was dorsal, his right plantar, the left knee jerk absent, right slightly exaggerated. All the deep reflexes on the left side were abolished; the left pupil more dilated but reacted slightly to light. He has very little power in his left leg and no power in the left arm. Pulse weak and irregular.

August 25.—Patient dull; at times cannot be roused; has Cheyne-Stokes breathing. Pulse, high tension and irregular. Examination with the ophthalmoscope shows marked swelling of the left disc. Knee jerk, right—absent. Babinski, right—absent. Knee jerk, left—present but slight. Babinski, left—present. No ankle clonus on either side. He has no power in his right arm; twitching at times in the right hand and forearm. Breathing stertorous.

August 27.—Passing fæces and urine involuntarily. Double optic neuritis is present, more marked on the left side; vessels greatly engorged. He was now quite unconscious. He was seen by Drs. Meyers, Scofield and myself and a diagnosis of tumor of the brain made and operation decided upon. This was accordingly proceeded with, the same afternoon at three o'clock. An opening was made over the right Rolandic area with an inch trephine; this was enlarged by saw-cuts, one above and one on either side of the trephine opening, and the intervening bone was removed piecemeal with rongeur forceps, making the opening 2½ inches square. The dura mater was very tense, and, on incising it, a large hernia cerebri immediately formed. Constant irrigation with normal saline (at a temperature in the irrigator

of 110° F.) was kept up during the operation. The pia mater was deeply injected, and the arteries showed plaques of calcareous material. The bleeding points in the pia mater were ligatured with catgut. The scalp was then closed and a dry dressing applied. His pulse remained weak after the operation, and at 10 P.M. he developed marked Cheyne-Stokes breathing and died at 5 A.M. from respiratory failure.

Dr. A. L. Graham did an autopsy and found, on opening the right lateral ventricle by a longitudinal section, a tumor about 5 cm. in diameter, situated posterior to the anterior part of the optic thalamus and in the crus cerebri. The cerebral vessels were congested and hard, the vessels at the base showing evidences of patchy sclerosis. Microscopic section shows it to be a spindle-celled sarcoma.

CASE III.—Mrs. M. F. R.; age forty; patient of Dr. H. J. Hamilton, with whom I saw her in consultation October 14, 1906, when she was suffering excruciating pain in the head, mostly over the right eye. She was in a highly excited and nervous condition, almost maniacal, with a suicidal tendency. There was external strabismus, ptosis and proptosis of the right eye and vomiting. No weakness of the muscles anywhere. Her chief trouble was violent pain in her head of a bursting character, which prevented her from sleeping and which she claimed was driving her crazy. She was very despondent and constantly asked for something to put her out of misery. The present trouble commenced in 1904, was worse in 1905, and has been increasing in severity ever since. She has had some twitching of the right side of her face.

Previous Illnesses.—She had tubercular disease of the skin of her wrist and above the knee, which healed; also had Pott's disease of the spine, which was cured after wearing a jacket.

Present Condition.—She now has pain in the back of her head as well as over the right eye; she is in a highly nervous condition and is fearful of everything. Pulse weak and rapid. Right pupil dilated; has diplopia with right ptosis. Dr. Colin Campbell examined her eyes and reported as follows: The *right eye* shows paralysis of the third nerve. She can only half open the lid; pupil all but fully dilated and inactive. The optic disc margin and vessels and retina near by are buried in a mass of watery exudate about 5 dioptres high; vessels rather small—

no hæmorrhages. Macula and periphery free of gross changes. *Left eye.*—Muscles normal; active choked disc 3 dioptres high, with small hæmorrhages on it and flakes of white exudate. Veins very full; macula and periphery normal; pupil small and inactive. Nothing would relieve the pain in her head but morphia, and this only slightly when a grain was given hypodermically.

Diagnosis.—Intracranial pressure from one of the following conditions: meningitis with thickening, tubercular or syphilitic tumor. It was decided to trephine in the right frontal region to relieve the pressure. This was done on October 17, 1906.

As soon as the bone was removed the dura bulged into the opening; the dura was incised and a large hernia cerebri developed. The anterior part of the base of the frontal lobe could be seen but there was no evident indication of the nature of the trouble. Some exploration was made of the frontal lobe but nothing discovered. The dura was left open and the skin flap closed except for a small opening for gauze drainage. The wound healed nicely except where left open for drainage, and here there was a considerable discharge of cerebrospinal fluid. She had almost immediate relief from the headache and vomiting. When the opening was allowed to close she had return of the headache and on opening it with a probe and giving vent to the cerebrospinal fluid the headache was immediately relieved. On one occasion when it had closed the House Surgeon was called up at 4 o'clock in the morning, and, finding the small opening closed, opened it with a probe and let out about two ounces of cerebral spinal fluid. The patient had immediate relief and went to sleep.

November 16.—Sees no better. Right ptosis almost nil and pupils semi-dilated; reaction very slight. The right optic disc merely obstructed by exudate. No hæmorrhage and almost no swelling. *Left eye.*—The outer margin of the disc clear; inner margin hidden by piabolic exudate. The disc looks pale but indistinct.

November 27.—Patient was taken home to-day in good condition. Pulse 100, temperature normal. Headaches entirely relieved and is able to take a large mount of nourishment and has no nausea or vomiting. She has required nothing for her pain since the operation. Her general nervous condition is markedly improved; the nervous, excited condition has entirely disappeared. She sleeps from seven to eight hours at night. Since going home

she eats her meals at the table with the family. The ptosis and diplopia have disappeared.

CASE IV.—Miss McC.; age thirty-five; patient of Dr. R. J. Wilson, with whom I saw her on November 10, 1906. She complained of intense pain in her head, most marked over the left occipital region. She taught in a kindergarten school until June last. Had the diseases of childhood and had diphtheria when a child and typhoid since. When she was eight years old she received an injury from the crank of a grinding stone in the left occipital region, which left a small indentation at that spot. In April of this year patient had a sense of dizziness and would lose sight for a moment or two. On one occasion she fell in the street and another time fell down the steps of her boarding house, but without injury, being able to get up immediately and go about as usual. She had the feeling in her head as if she would fall and was constantly holding her hand up to guide herself about the room. She continued to teach in school until June 27, 1906. At this time the pain in her head became so severe that it seemed unbearable. She has lost her sight within the last four weeks, but up to that time she was able to read.

Her condition on entering the hospital on November 12 was as follows: Is very talkative, fairly well nourished, pupils widely dilated. She can distinguish daylight from darkness and she can tell when a hand is passed before her. She has weakness of the external recti; there is some weakness also of the left superior rectus, and internal strabismus of the left eye. The pupils do not react to light or accommodation. She is not able to wrinkle the left side of her forehead or wink the left eye; her tongue is protruded to the left side and when she attempts to blow or whistle the left side of the mouth droops. She has had weakness of the left side of her face for some months. In eating, food would accumulate in the left cheek. The grip of the left hand is weaker than that of the right. She has had considerable vomiting, independent of food. The right knee reflex is exaggerated—left normal. There is loss of the sense of smell in the left nostril and loss of hearing in the left ear.

Dr. Colin Campbell examined her eyes and reported as follows: Eyes staring; right eye the better of the two; left eye converges; outward movement defective; no obvious facial paralysis: Pupils: *right,* slightly smaller; both react sluggishly, espe-

cially the left. Both pupils larger than normal; right, slightly smaller. Double optic neuritis. In the right eye the swelling of the disc is 4 to 6 dioptres high. Veins moderately distended; vessels near the disc varied in exudate. A few small hæmorrhages only; no macular figures. Rest of fundus normal. *Left eye.*—Swelling of disc only 2 dioptres high. The outer margin of the disc almost visible; macula clear. The margins of the disc show white radiating appearance of exudate. It appears to be subsiding.

She was seen by Dr. Campbell Meyers and Dr. W. P. Caven, and they concurred in the diagnosis of tumor of the cerebellum, probably of the left side.

I operated on November 14, trephining over the left cerebellum. The dura mater bulged into the wound. The trephine opening was enlarged ¼ inch on either side and the dura incised. The cerebellum immediately projected out through the opening in the dura to a distance of ½ inch above the surface of the bone. The cerebellum over an area the size of a twenty-five-cent piece looked injected and infiltrated. On feeling this projecting portion one could make out distinct fluctuation. Cerebellar tissue was separated a little, exposing a grayish membrane, through which a director was passed and from 2 to 3 ounces of clear fluid removed. A pair of artery forceps were passed along the groove of the director and the opening enlarged, when a distinct cyst with thickened walls could be made out. Normal saline at a temperature of 120° was kept constantly running over the wound during the operation. After evacuating the fluid the cyst collapsed and the cerebellum receded, leaving a distinct depression. An opening was left in the dura to allow of a small strip of sterile gauze being inserted for drainage, and the wound closed except where this was brought out.

November 14—Evening.—She has rested fairly well since operation. The pain in her head has almost entirely disappeared.

November 15.—Patient had a good night; pupils slightly active to light but not to accommodation. Patient is able to distinguish dark from light colors and able to count fingers. Dressing done; there was considerable oozing of clear fluid and blood.

November 16.—The pain in her head has entirely disappeared. Had a little soreness between the scapulæ; she is able to recognize odors through the left nasal orifice, oil of wintergreen

being placed on a wipe while the right orifice was closed; hearing in the left ear somewhat improved. Packing removed from wound.

November 17.—Had a good night—no pain or headache is felt and no vomiting. A tube was put in for drainage to replace gauze. Movement of the eyes much improved. Patient complains of hyperæsthesia of left side of face; tongue can now be protruded without deviation to the left; pupils quite active and sight much better. She can recognize the faces of those about her.

November 19.—Hyperæsthesia has about disappeared; patient can wink the left eye and wrinkle her forehead; pupils active; great deal of oozing of straw-colored fluid from wound.

November 20.—Wound healed entirely by first intention, except for the small opening left to provide drainage.

November 29.—Patient able to read the headline of a newspaper; able to distinguish house surgeons, nurses and friends. Can distinguish colors.

December 1.—Can see the snow flakes falling against the window. The discharge of clear fluid diminishing.

December 2.—Patient out in a wheel chair; is quite steady—no dizziness; no pain; eyesight steadily improving. She feels perfectly well. Can recognize people entering the door of her ward.

Case V.—S. F.; age ten; patient of Dr. Eadie. I saw him in consultation with Drs. Eadie and W. P. Caven on November 23, 1906. He was quite well until last March, when he commenced to have what his parents thought to be bilious attacks once a week. These attacks consisted chiefly of bad headaches, and during this time he would not eat. During August and September he was at Jackson's Point. His father consulted Dr. Eadie in the first part of August, and Dr. Eadie first saw the patient October 1, 1906. His attacks were becoming more frequent and more severe and for the last month he had had three attacks in a week. Once a week the attack was a very severe one. The headache complained of was general. The patient said he felt it all over his head. His temperature was taken every morning for some weeks and found to be normal. He has vomited altogether seven or eight times during the attacks. He has lately been having them every second day, waking in the morning with severe headache.

In the middle of October Dr. Duncan examined his eyes and found double optic neuritis. We had Dr. Duncan examine the eyes again on November 26 to see if he could determine which eye was first affected, so that we might have some guide as to the side of the tumor, and he reports that there is no difference in the discs of the two eyes to indicate which one was first affected. The papillitis has not progressed. He has absolutely no localizing symptoms. Examination of the heart, kidneys, lungs, etc., negative. He has been an exceptionally healthy boy since birth, not having the usual children's sicknesses.

Diagnosis.—Increased intracranial pressure, probably due to tumor. We concurred in advising trephining for the relief of pressure, hoping to relieve the headaches and prevent the optic neuritis progressing to blindness. This was agreed to and the operation was accordingly performed November 28, 1906. Dr. McMahon gave chloroform; Dr. Eadie assisted me. As there were no localizing symptoms, trephining was done in the right temporal region, an area of bone 2 inches square being removed. The dura mater was very tense and on opening it a large hernia cerebri immediately formed. The brain was explored in several directions to a depth of a couple of inches but nothing was found. The dura was left open and the scalp closed without drainage and a dressing applied. As soon as the effects of the anæsthetic passed off he was quite comfortable. He has been quite free from pain and vomiting since the operation. The wound was healed by first intention; temperature and pulse are both normal, and he has made a rapid and satisfactory recovery.

These cases would indicate, in the first place, how important it is that they should be submitted to surgical treatment early, and, secondly, what good results can be obtained by the very safe and simple procedure of trephining.

THE OPERATIONS FOR NEOPLASMS OF THE TONGUE.*

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A BRIEF historical review of the different typical operations and a short description of each will aid greatly in the selection of a method which may be suitable for any given case. Although "cutting off the tongue" was a favorite punishment which in ancient times seems not to have been attended by any great degree of mortality, operators were very slow to take the hint it gave, and the fear of hæmorrhage retarded the progress of the surgery of this organ until only about twenty or thirty years ago. The ecraseur or some similar plan of constriction was for a long time the favorite means of attack in all instances demanding interference, and even now there are conceivable circumstances in which this method might be justifiable, as in certain angeiomatous conditions. Hence on this account, as well as for historical completeness, the means at our disposal for compressing the base of the tongue should be at least mentioned.

The avenues of approach for removing the whole or a portion of the organ may be classified as through (1) the mouth; (2) the jaw; or (3) the neck. There are occasional references to extirpation of new growths in the tongue through the mouth during the XVII and XVIII centuries, and Marchetti of Padua in 1664 was apparently the first to thus remove a carcinoma.[42] Inglis, in 1805, in a case of tumor on the border of the tongue, passed several ligatures through the tissues surrounding it, and by tightening them caused the tumor to slough out and thus obtained a cure in the course of three or four weeks. The elastic ligature seems to have been used

* Read before the New York Surgical Society, January 9, 1907.

about 1850, and Langenbuch [24] in 1878 advised the application of this principle as a preliminary to the removal of certain angeiomata. After drawing the tongue well out and, if necessary, dislocating the jaw forward, a large curved needle carrying a stout silk ligature is entered as far back as possible in the dorsum just to one side of the median line. This passes through the tongue substance, under the lingual vessels, enters the mouth between the jaw and the tongue and again penetrates the edge of the tongue. Another ligature is similarly passed through the opposite side, overlapping the first in such a way that when both ligatures are tied all the vessels and the whole substance of the tongue except its edges are constricted. (Fig. 1.) The disease is then removed with knife or cautery.

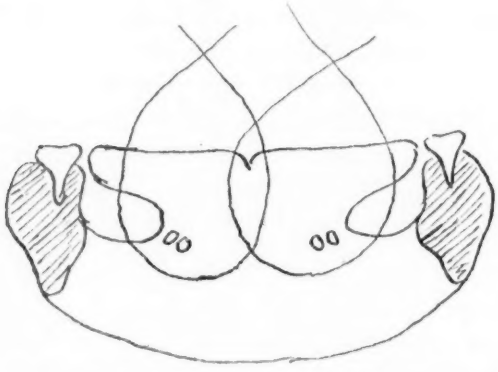

FIG. 1.—Langenbeck's method of constricting the tongue by sutures passed through its substance.

The chain, or wire, ecraseur introduced by Chassaignac in 1854, as stated previously, was once quite extensively used and was passed around or through the tongue and sometimes several were applied simultaneously. Middledorpf, about 1860, was thought to have slightly improved the instrument by making of it a galvano-cautery; but the hæmorrhage, both primary and secondary, which it was principally designed to control, occurred frequently enough to cause its eventual abandonment. In the elaboration of preventive hæmostasis Cloquet, in 1827, was probably the first to surround the base of the tongue by a ligature entered through the neck. He introduced a needle

carrying a stout suture in the middle line just below the hyoid bone, and brought it out in the pharynx between the tongue and angle of the jaw. It was similarly passed on the other side and the ligature was drawn tightly and knotted on the surface of the neck. Arnott, in 1838, made the procedure more exact by a preliminary vertical incision through the skin and mylohyoid muscle, and Nuneley,[31] in 1861, gained some reputation by employing this route for applying Chassaignac's ecraseur. To prevent the ligature, wire, or chain from slipping forward, knitting needles have been passed through the tongue back of the growth while the mouth is widely distended, or as Barwell,[2] in 1879, suggested, long steel needles have been similarly passed up from below through the opening made for the ecraseur above the hyoid. Fiorani,[15] in 1882, pushed a trochar and cannula from a slit in the skin just above the hyoid bone into the pharynx far back between the tongue and tonsil, first on one side and then on the other and after withdrawing the trochar introduced a silk ligature. The intraoral ends were then drawn out of the mouth and knotted and then slipped back after withdrawing the cannula. And by attaching a stout rubber band to one cervical end of the ligature an elastic tourniquet was thus dragged in and made to surround the vessels at the base of the tongue and tightened by a clamp under the chin.

The credit for recommending preliminary ligation of the lingual artery through the neck above the hyoid bone has been ascribed to Mirault,[29] in 1833, or to Roser[34] or Roux[35] in 1839; and Maissoneuve[27] was probably the first to extend this in urging the preliminary exposure and ligation of the external or even the common carotid for extensive operations. It is interesting to note that this procedure about the same time was much advocated for purposes of starving out the growth, and there is occasional mention before 1860 of its usefulness for removing secondary enlarged cervical glands.

Although there are several earlier instances of excision of lingual neoplasms with the cautery, C. J. M. Langenbeck,[22] in 1819, seems to have been the first to record the clean removal

of a tumor of the tongue through the mouth by a V-shaped incision around it and immediate suture of the resulting wound. This method was afterwards practised and recommended by Dieffenbach,[13] who as a preliminary to the incisions, inserted sutures to insure immediate coaptation of the cut surfaces and so obtain hæmostasis. Excision with the knife or scissors was thus in use long before the operation was popularized under the name of its more recent advocate Whitehead,[41] who proceeds as follows: The patient is anæsthetized in a sitting position in a " rocking " chair; the mouth is held widely open with a suitable gag, and the tongue drawn out by a stout ligature passed through its tip. Using only scissors curved on the flat, the frenum is cut and then the mucous membrane along the base of the tongue on one or both sides according to the amount of the organ to be removed. If the diseased portion is not then sufficiently accessible, one or both anterior pillars of the fauces with the underlying styloglossus muscles are divided. If only half the tongue is to be removed it is then split in the median line and cut across about three-quarters of an inch behind the disease. If the whole tongue is to be excised a ligature is first passed through its substance in front of the glossoepiglottic fold (to prevent the stump slipping back out of sight) and the section made anterior to this point.

Originally he recommended that the vessels be seized and twisted as they were cut, and no ligatures seem to have been applied; but later he advised that after section of the mucous membrane at the side of the tongue, the vessels should be isolated by blunt dissection and seized with forceps before cutting. He has always strenuously objected to division of the jaw and to preliminary tracheotomy, and for the latter deserves great credit. Apparently he only removed the cervical glands when they were palpable, and generally at a later operation.

Jacobson [18] uses this method whenever it is possible thus to make the section one inch beyond all disease, and he removes the glands first, if it is necessary to perform the operation in two stages. When only one half of the tongue has to be

excised he passes a ligature through each side of the tip and splits it down the middle and then cuts the mucous membrane along the floor of the mouth on the diseased side, the corresponding anterior pillar of the fauces and the thick mucous membrane on the sides and dorsum of the tongue an inch back of the tumor. After these steps the vessels are isolated in the soft muscular tissue by blunt dissection and seized and ligated before completing the section. Cathcart [6] has improved upon this method of hæmostasis as follows: A traction ligature is passed through each half of the tip of the tongue; the mucous

FIG. 2.—Jaeger's method by splitting the cheek.

membrane is then split mesially with straight, blunt-pointed scissors throughout the whole length of the dorsum, and under the tip into the frenum and along the base of the tongue on the diseased side between the tongue and jaw. The geniohyoglossus muscle on the affected side is then defined and its attachment to the symphisis cut, allowing the corresponding half of the tongue to be still more drawn out. The anterior border of the hyoglossus on this side is defined by a director which is passed beneath it, and on this the anterior two-thirds

of the muscle is cut transversely, exposing the artery pulsating at the bottom of the wound, where it is seized and tied and the diseased half of the tongue excised.

In 1832 M. Jaeger [19] (Fig. 2), to gain better access to the back of the tongue, advised splitting one cheek outward to the anterior border of the masseter muscle on a line drawn from the angle of the mouth to the base of the mastoid process. This avoids the parotid duct and generally all important branches of the facial nerve. Maissoneuve [27] in 1852 carried out this plan on both sides of the face, and though it has occasionally been employed since then the gain in space is not enough to make the method often useful.

FIG. 3.—Sedillot's incision.

As the operations through the mouth should always be accompanied by removal of the cervical lymphatics some mention should be made here of the possible methods for exposing these structures. Their removal in one mass with the attached fat and fascia from the sternum to the base of the skull together with the submaxillary and sublingual salivary glands, as these constantly contain lymphatics connected with the rest of the system, is theoretically best for permanent cures but not best for all individuals. More surgeons will agree to a complete removal of all dangerous tissue on one side than on both sides, and it may only be necessary to remove the lymphatics and the submaxillary and sublingual glands between the jaw, hyoid bone, and mastoid process. For exposing these there are the

usual straight incisions along the anterior border of the sterno-mastoid muscle, with liberating ones passing to the chin at a right angle, or the disfiguring S-shaped incision formerly suggested by Hartley [16] or that of Stieda [38] following the lower border of the jaw, or the H-shaped incision of Eisendrath.[14] If the operation has to be done in two stages it seems generally wiser to remove the primary disease in the first sitting and the lymphatics in the second.

The first recorded section of the jaw for removal of the tongue seems to have been performed by Roux in 1836,[35] who divided the lower lip vertically in the median line and the underlying symphisis. This operation generally goes under

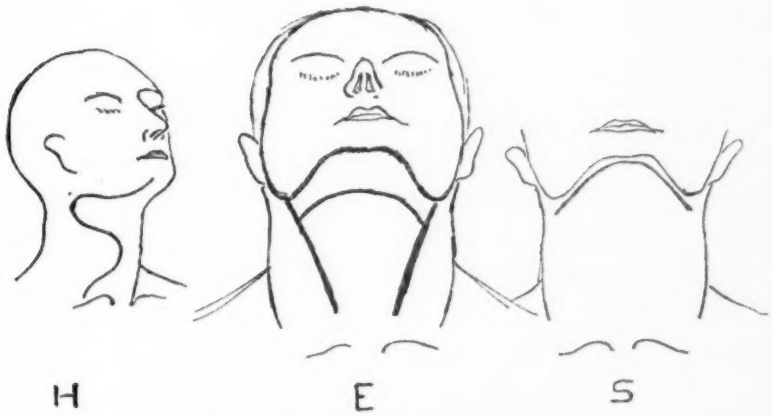

FIG. 4.—Incisions for removing lymphatics.
H. Hartley. *E.* Eisendrath. *S.* Stieda.

the name of Sedillot's, who apparently without knowing of his predecessor or at least without referring to him, in 1844 did practically the same thing making a > shaped section at the symphisis. In England the operation was known as Syme's,[39] as he introduced the method in 1856 also without reference to previous surgeons, but employed a vertical section at the symphisis with an incision extending in the middle line through the edge of the lip to the hyoid bone. This operation at first was attended by a very high immediate and secondary mortality, both on account of the extent of the disease requiring the

procedure and the subsequent difficulty in deglutition. Langenbeck (Fig. 5) in 1875, improved on this method by dividing the jaw on the diseased side just in front of the last molar tooth from behind forward and from within outward, after first boring holes in the jaw on each side of the proposed line of section. The skin incision extends in a straight or slightly curved line from the angle of the mouth to the sternomastoid muscle at the level of the thyroid cartilage; and the dissection begins from below. The lymphatics and submaxillary gland

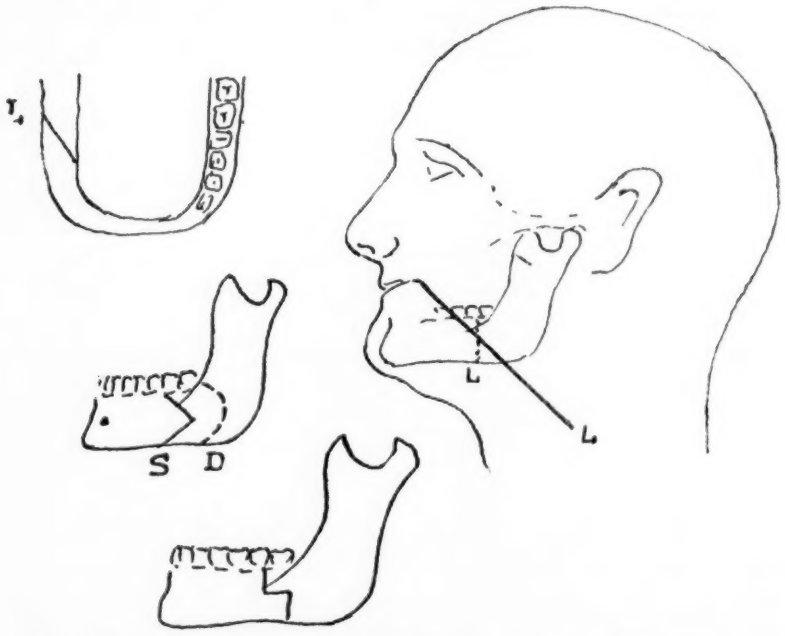

FIG. 5.—Langenbeck's operation (*L*, *L*, *L*). Sedillot's method of cutting the jaw (*S*). Downes' method of cutting the jaw (*D*).

are removed, the digastric and stylohyoid muscles and generally the hypoglossal nerve are cut, and in the original method the lingual artery is tied, although a preliminary ligation temporary or permanent, of the external carotid makes the operation shorter and so safer. After cutting the jaw the tongue is drawn out through the wound by a ligature in its tip and as much as need be excised together with one or both

lingual nerves. The raw surface within the mouth is then closed by sutures as far as possible and the jaw is united by wires or silk sutures passed through the holes bored before it was divided. A partial suture of the external wound, with drainage in its lower angle extending into the mouth, follows. Of all the methods this probably gives the freest and most satisfactory access to extensive disease or that located in the posterior portion of the mouth; but it of course results in paralysis of half of the lower lip, and to avoid this Crespi and Bastianelli[3] (Fig. 6) in 1890 made an angular shaped ⌐ incision vertically through the middle of the lower lip, then

FIG. 6.—Bastianelli's incision.

along the inferior border of the jaw to the sternomastoid and down that over the great vessels as far as need be. The skin and soft parts are raised to about 2 cm. in front of the masseter, exposing nearly all of the lower jaw, which is sawed through as in the original Langenbeck operation, in front of the last molar tooth or at any desirable point.

Kuster,[21] in 1885, combined Langenbeck's skin incision with Mikulicz's method of pharyngotomy, by excision of the ascending ramus of the jaw, and in instances where the disease involves this part of the bone or the attached soft parts it presents advantages. The original Mikulicz pharyngotomy (Fig. 7) was undertaken for removing a cancer of the tonsil,

and also gives moderately free access to the glosso-epiglottic region of one side. The incision extends from the base of the mastoid process downward for about three inches along the anterior border of the sternomastoid muscle. Through this the soft parts are raised from the inner and outer surface of the ascending ramus of the jaw with a periosteal elevator, the mouth entered opposite the last molar tooth and the bone sawed through at the angle. The upper anterior portion of the wound with the overlying parotid gland is drawn forward and the ramus backward, while the insertion of the temporal muscle is separated with the knife, or the coronoid process is cut through at its base with forceps. Then the ramus, aided by a few snips with scissors, is twisted or torn out of the joint. Aided by a finger or urethral sound in the pharynx, the latter is opened after dividing the digastric and stylohyoid muscles in front of the carotids, and above the superior laryngeal nerve, which should be spared.

Minor modifications can be made of Bastianelli's [3] incision, such as prolonging the wound in the lips to and along the hyoid bone, for the removal of secondary deposits, or placing it on one or the other side of the mental foramen to adapt the flaps so as to expose any secondary or extensive growth and preserve as much as possible of the motor and sensory nerve supply of the face. Czerny [11] has thus combined Jaeger's and Langenbeck's methods by splitting the angle of the mouth backward to the masseter muscle and then carrying the incision vertically downward through the soft parts and the bone to the thyroid cartilage, but only in exceptional instances would such an opening be necessary. In another case median division of the lower lips and chin, with a prolongation of the incision, as in Kocher's operation, was accompanied by removal with the lingual disease of the entire corresponding half of the lower jaw. Rose [33] in 1900 thus successfully removed the tongue and all the soft parts in the floor of the mouth down to the hyoid bone, and the entire lower jaw with the exception of one ramus and enough of the attached body to permit the retention of the corresponding two posterior

molar teeth. The patient a year afterwards was in good condition and showed no recurrence. Also Kocher in 1890 combined in one case his usual incision with a prolongation downwards along the sternomastoid and section of the jaw at the angle.

The only osteoplastic method which has been recommended is known as Billroth's (Fig. 7) and was described in 1862. A vertical incision is made from each angle of the mouth to below the lower border of the jaw, which is then sawn

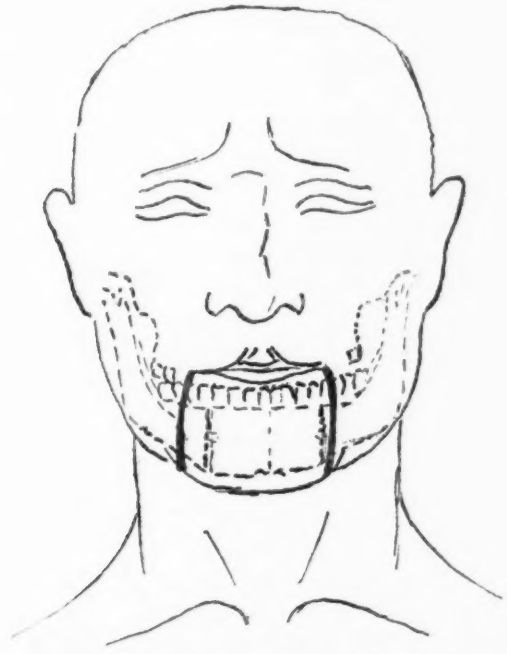

FIG. 7.—Billroth's osteoplastic method.

through on these lines and the chin with the attached soft parts then displaced downward. After removal of the disease the bone is replaced and held in position by sutures.

The manner in which the jaw is cut and afterwards united is of considerable importance. In the earlier methods a straight transverse, a < shaped or ⌐⌙ angular division was made with the saw directed in different planes for each angle with the object of avoiding displacement, but the geometrical law that

the intersection of all plane surfaces is a straight line prevails and displacement cannot thus be escaped. In division near the angle the posterior segment, under the influence of the pterygoid muscles tends to be drawn inward and division from behind forward and within outward, thus making the posterior overlap the anterior segment, is best. In this region also a C shaped (as suggested by Dr. Downes of this city) or < shaped section helps to minimize the tendency to upward and downward variation. But with any saw, and especially the Gigli wire instrument, there is considerable loss of tissue which increases the difficulties of adjustment; possibly the use of giant bone forceps, as suggested by one of the English surgeons,

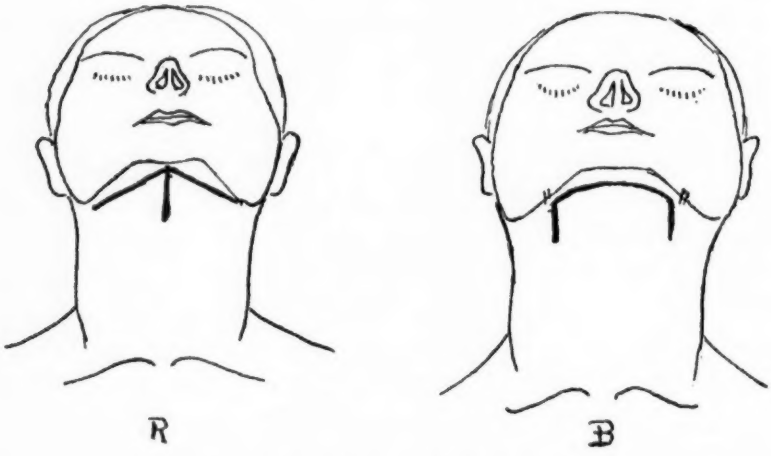

FIG. 8.—*R*, Regnoli's operation. *B*, Billroth's modification.

would leave the closest-fitting joint. In reuniting the segments the preference is generally given to silver wire sutures passed through holes bored on each side of the line of section before the latter has been completed. It is very difficult to bore them afterwards. And two sutures assure better retention than one. Petersen,[32] in 1887, advised fastening the segments (sawn so as to overlap) with silver nails driven through the cheek, though in old people, owing to the danger of fracture, holes should previously be drilled. Dr. K. C. Gibson, the dentist who has had the most experience with interdental

splints, informs me that he advises against such appliances in these cases on account of the difficulty of maintaining cleanliness; but in cases requiring more or less extensive removal of the jaw some prosthetic apparatus should be worn for about a couple of weeks to prevent bad displacement of the remaining segments.

The earliest of the operations upon the tongue by the route below the jaw or through the neck is known as Regnoli's [36] (Fig. 8, R) (published in 1838) whose /\ shaped incision began opposite the symphisis and followed the lower border of the jaw to the angles and was supplemented by a median division of this flap. Billroth (Fig. 8, B) in 1874 modified this by an incision of 3 to 4 cm. following the lower border of the jaw, with its centre opposite the symphisis and its extremities just avoiding the facial arteries. From each end of this, straight liberating incisions were carried backward and downward to the greater cornua of the hyoid bone. After division of the attachments of the digastric and mylohyoid muscles, the inner surface of the concavity of the jaw and the genial tubercles were freed of soft parts by the periosteal elevator, the floor of the mouth entered and the tongue drawn out on the neck and as much as need be excised. Owing to the complete division chiefly of the geniohyoid and geniohyoglossus muscles the subsequent difficulties in degultition and breathing seem to have been considerable and were apparently the principal factors in the high mortality of 25 or 30 per cent. in this operation.

Czerny (Fig. 9, Z) in 1870 was apparently the first to advise the lateral inframaxillary route. His incision extended from the symphisis to the middle of the hyoid bone and then along its upper border to the edge of the sternomastoid muscle. Through this opening the lingual artery was tied in its triangle, the skin and platysma were dissected up to the jaw from the inner surface of which the periosteum and attached soft parts were raised by a periosteal elevator, from the angle to the symphisis, until the mucous membrane was reached and divided close to the teeth. Then the anterior attachments of the geniohyoid and geniohyoglossus were sev-

ered and the tongue drawn out on the neck. At the same time with the primary disease the sublingual and submaxillary salivary and lymphatic glands of one side could thus be removed. Kocher's operation (Fig. 8, K), published in 1880, differed from this slightly in the external incision which extended along the anterior belly of the digastric from the symphisis to the hyoid, following its upper border to the sternomastoid and then upward to a point opposite the mastoid process. The flap was raised, exposing the muscles; the submaxillary and sublingual glands were then excised, the vessels tied in the lingual triangle, the mylohyoid cut close to the jaw and the tongue drawn

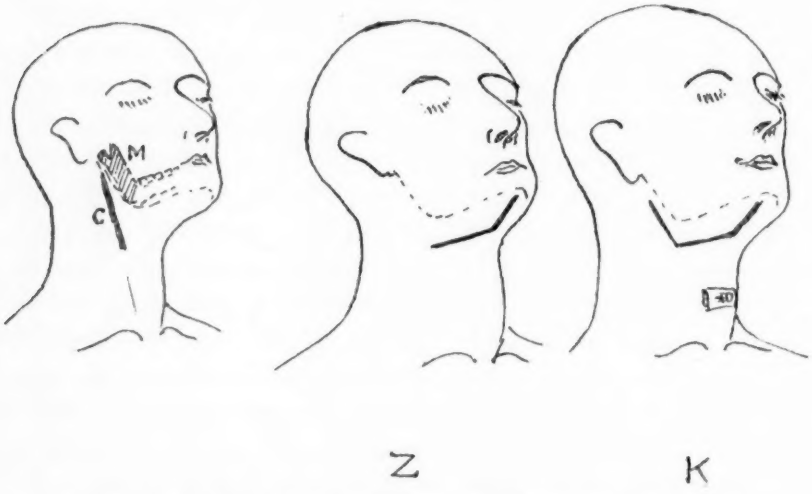

FIG. 9.—*C*, *M*, Mikulicz method of pharyngotomy with excision of ascending ramus of jaw. *C*, Cheever's incision for pharyngotomy. *Z*, Czerny's inframaxillary operation. *K*, Kocher's operation with preliminary tracheotomy.

below out of the wound, without interfering with the muscular attachments to the genial tubercles. After free excision of the disease the wound was partially closed and packed. The chief feature of the procedure was, however, the preliminary tracheotomy and tamponade of the pharynx and trachea to prevent the septic pneumonia which was always the most frequent cause of death. He thus presented a series of cases with a 7 per cent. mortality instead of the usual 20 or 30 per cent.,

which had been the experience of others, and his methods thereafter were widely adopted.

Cheever's lateral pharyngotomy (Fig. 9, C) introduced in 1869, does not give as free access to the back and base of the tongue as Mikulicz's operation, but it is less mutilating and might occasionally be useful. A three or four inch incision is carried downward from the base of the mastoid process along the anterior border of the sternomastoid and through this, after division of the digastric and stylohyoid muscles, the pharnyx is entered in front of the vessels and above the superior laryngeal nerve.

Subhyoid pharyngotomy by transverse division of all soft parts in this situation could not be as useful as the corresponding suprahyoid operation and neither operation gives as satisfactory access to the rare benign growths of the base of the tongue, for which alone such an approach is justifiable, as Vallas[40] transhyoid pharyngotomy described in 1900. In this an incision is carried from the symphisis to the pomum Adami, the hyoid cut in the centre with bone forceps and the wound deepened, if necessary, through or to one side of the epiglottis until the pharynx is opened; or previous to the section of the hyoid, Kocher's flaps are raised on one or both sides and, after ligation of the vessels in the lingual triangle and extirpation of the glands, these lateral incisions are closed, the bone cut and the pharynx then opened and the primary disease in the tongue thus exposed and removed.

It has generally been customary to close by suture all the raw surface possible which may be exposed within the mouth and Lane,[25] in 1892, advised the formation of flaps of the remaining sound mucous membrane to facilitate this, and the turning of the tip of the tongue if present, around into any lateral gap.

As a palliative operation for the relief of pain Hilton,[17] in 1850, was the first to introduce section of the gustatory nerve in the floor of the mouth betwen the tongue and second molar tooth. By knicking the mucous membrane and a little blunt dissection, it can be found here just behind the sublingual

gland; or, better, after the method of Moore;[30] the tip of the tongue is drawn well out of the mouth toward the opposite side and the nerve cut just below the mucous membrane by a three-fourths-of-an-inch incision on the line passing from the crown of the last molar tooth to the angle of the jaw. The edge of a sickle-shaped knife, to reach under the mylohyoid ridge, is directed toward the bone.

In all these different methods, and at all times pneumonia, shock, hæmorrhage and sepsis, about in this order, seem to have been the most frequent cause of an immediate mortality which has gradually decreased from between 30 and 40 per cent. to between 5 and 15 per cent., depending upon the extent and duration of the disease and the severity of the operation necessary for its removal. Death from the recurrence of cancer has generally been produced by its growth in neighboring lymphatics, or diffusely in the wound made for the original removal of the disease, less often in the stump of the tongue and rarely from metastases in distant organs. The percentage of permanent cures has varied in different statistics from 10 per cent. to 30 or 40 per cent., and seems on the average to be nearer the former than the latter figures. But so many factors have to be considered that one can only say there are enough chances of success to make all but the clearly hopeless cases worthy of trial.

As regards the mortality following the different operations the statistics are naturally greatly in favor of those I have described as Whitehead's, coupled with thorough removal of the cervical glands. And it is decidedly worthy of note that in these cases usually only a portion and not the whole tongue has been removed. This implies, of course, that patients treated by excision of the disease through the mouth must usually have presented themselves at an early stage, but it by no means covers all such operations performed by the English surgeons, who seem seldom to use any other method and whose results compare very favorably with the commonly more drastic and mutilating procedures of the Germans. When, therefore, the line of excision can be made at least

three-quarters of an inch wide of the growth, through sound tissues by Whitehead's method, experience has apparently proved it the best both for immediate and late mortality. Jaeger's plan of splitting the cheek outward, as remarked previously, increases only to a slight degree the amount of space offered by the natural opening, and as it adds an unsightly cicatrix and some risk of auto-innoculation of the wound and more or less facial paralysis, it is not to be generally recommended, although for some unusual case it might be of service and so should not be forgotten.

Before passing from the operations through the mouth to those which can only be carried out by other methods, some reference should be made to the amount of the tongue which it is necessary to remove for malignant disease and the advisability of excising the latter where there is a considerable or deep involvement of the anterior part of the floor of the mouth. It seems to be the general practice in Whitehead's, as in other operations, even when the disease involves only a portion of the lateral border, to begin at the tip of the tongue and cut through the middle line to a point about three-quarters of an inch behind the growth, and this is also done when the tumor is well back of the anterior extremity of the organ. I can find no good anatomical reason for this, as the lymphatics do not run forward but downward or backward, and although the exact line of section is not generally described, the results, as regards local recurrence, appear to be equally as good when the lateral disease is excised by a simple V widely around the sides of the neoplasm as when the whole of the organ is removed. Hence, as the tip of the tongue is very necessary for speech and for mastication, it should be spared whenever it is not within at least half an inch of the new growth, or it may be partially turned back for plastic closure of a large lateral defect.

The advisability of operating upon a cancer which involves the anterior attachments of both geniohyoid and geniohyoglossus muscles needs much consideration. Pneumonia is and has been the most frequent cause of death in all operations upon

the tongue, and while formerly the aspiration of blood was thought to be the chief etiological factor, it has of late been generally conceded that interference with deglutition is far more important in this respect, and that while exhaustion from shock and hæmorrhage can predispose to this dangerous intercurrent affection, any additional burden upon the act of swallowing makes the chances of an attack of pneumonia greater. The fatalities due to this disease caused the abandonment of Billroth's osteoplastic method of resection of the anterior segment of the jaw and finally of his and Regnoli's submental operations and the general adoption of the lateral operations, or of Whitehead's (all of which usually leave intact at least one geniohyoid and part of one geniohyoglossus muscle), has been followed by a great improvement in the pneumonia mortality. Hence it is apparent that operations which involve separation of all the muscular attachments from the genial tubercles present a grave prognosis, and the subsequent difficulties dependent upon breathing and swallowing may be so great as to seriously raise the question whether or not such a procedure is justifiable. Personally I believe that it is seldom proper.

For cases in which the disease is located far back in the mouth or in which one or other pillar of the fauces or the tonsil or pharynx is involved, Langenbeck's operation, or more rarely Sedillot's, is the one of choice. These methods not only leave undisturbed the muscular attachments to one or both genial tubercles but they both, especially Langenbeck's, provide very free access for operations in the oral cavity, and at the same time expose the cervical glands and the great vessels. It has been my experience that not only is preliminary ligation of the external carotid simpler and therefore more quickly carried out than ligation of the lingual but it is equally safe and far more effective in facilitating all the steps in the rather extensive interference in these more difficult cases. The operations through the neck, such as Billroth advocated, have practically been abandoned for the reasons stated above, and Kocher's lateral inframaxillary route with its attendant preliminary tracheotomy, once so popular, is now seldom practised—and

for several reasons, one of which at least I have not observed to be noted in the literature as a valid objection. This is the liability to recurrence of the cancerous elements diffusely in the line of the cicatrix. Kocher's incision provides so little space that the force necessary to drag the tongue down within reach through the cervical opening involves considerable risk of auto-inoculation of the wound, if the epithelioma, as is usual, is an open ulcer. And in former days, when the operation was more frequently employed than at present, I have several times observed this occurrence. Auto-infection of a fresh wound with malignant disease is an ever present possibility in all operations, especially in those upon the head and neck, and ought to be more emphasized than it is.

The frequently fatal pneumonia which was and often now is attributed to the aspiration of blood into the lungs, must be ascribed chiefly to difficulties in deglutition, though hæmorrhage with its attendant shock and prostration is undoubtedly a contributory factor. Hence preliminary tracheotomy with the attendant tamponade of the trachea and pharynx, should generally be avoided as it contributes only its own additional dangers and increases the patient's difficulty in swallowing, and general discomfort. A thorough preliminary hæmostasis by permanent or temporary occlusion of the external or even the common carotid, as Crile advises, is far more rational. If, however, there is dread of foreign matter entering the larynx during the operation, an O'Dwyer laryngeal catheter or Crile's rubber tube instrument is an efficient substitute for the more dangerous tracheal cannula.

In conclusion a word should be said about the after-treatment, or rather the preparatory treatment, of these patients whose nutrition is apt to be so badly impaired; many of them, especially if the jaw has had to be divided, have great difficulty in taking nourishment, and feeding by a stomach tube during the first week of convalescence is absolutely essential. If before the operation is undertaken the individual for a few days is habituated to lavage and goes through a course of mouth and tooth cleansing, the subsequent chances of safety and comfort are greatly increased.

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A METHOD OF USING THE TONGUE IN SUPPLYING A DEFECT OF THE CHEEK.

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It is generally admitted to be very difficult to close an extensive gap in the cheek by any sort of a plastic which contemplates the use of the tissues of the face. The principal difficulty lies in completely clothing the interior with mucous membrane.

But recently I hit upon a plan of accomplishing the desired end with surprisingly little difficulty, even though I had sacrificed practically all the mucous membrane between the upper and lower alveolar processes on one side. The idea is so simple, and the means of relief in such a case lie so near at hand, that I was greatly surprised to find nothing of the same kind readily accessible in the literature of the subject.

The patient was a well preserved man of seventy-one. A year previous to the time that I first saw him, which was December 6, 1906, a sore appeared on the inner surface of the left cheek, he supposing the same to be due to the mucous membrane having been scratched by a tooth. Six weeks before he came to me, what he speaks of as a sore, appeared on the outer surface of the same cheek exactly opposite the interior lesion to which reference has just been made. By the time I saw him these symmetrical lesions were each of them about the size of a quarter, located, as has been mentioned, one of them on the skin, and the other on the mucous membrane of the left cheek, midway of the alveolar processes and about 1 cm. from each of these. The edges of the lesions were elevated, indurated and their bases were semi-necrotic. Evidently the process was carcinomatous.

On December 7, 1906, a circular incision about ½ cm. away from the diseased tissue, and completely encircling the growth, was made through the entire thickness of the cheek. The result-

ing defect appeared surprisingly large in view of the elasticity and consequent natural retraction of the tissue involved. It was, of course, impossible to bring the mucous membrane edges together, in view of their firm attachment to the alveoli, not more than ½ cm. away. Confronted by this state of affairs, I made a deep horizontal incision into the side of the tongue, practically separating half of the member into two flaps, an upper and a lower. The edge of the upper flap was sutured with catgut to the fringe of mucous membrane which adhered to the superior maxilla, and the edge of the lower flap was united in like manner close to the inferior maxilla. The separation of these tongue flaps revealed a raw muscle surface, which naturally furnished the best sort of a base upon which to implant the superficial tissues of the cheek. By undermining the skin above and below the external defect, I had no trouble at all in bringing its edges together. A few silkworm sutures were placed through the skin and the body of the tongue, in order not only to approximate the edges of the former, but, at the same time, to obliterate any dead space which might otherwise have formed.

I will state in passing that the patient had no teeth at all on the operated side. Three days after operation a few drops of saliva escaped through the wound; five days afterward all looked well. When eleven days had elapsed, the silkworm sutures were removed and the healing found to be perfect in every particular; the tongue was naturally anchored in place. Fifteen days after the operation I examined the patient and found that chewing, talking and swallowing were absolutely normal. One month after the procedure he expressed himself as being delighted with his condition, the scar was soft and yielding, he had no difficulty in opening and closing his jaws, while the change in his external appearance was surprisingly slight.

An examination of the interior of the mouth showed the tongue firmly fixed in its new position, but still capable of a very wide range of movement.

It may be stated in general that the method could be made applicable to any patient, simply by withdrawing the teeth on the afflicted side, and I am confident that the surgeon who tries it will be astonished at the ease with which he can close almost any defect in the cheek.

INJURIES AND DISEASES OF THE HYOID BONE.*

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THE hyoid bone is a small structure, and is situated in such a position as to be well protected from injury, yet one is surprised to find so little space devoted to a study of its diseases and injuries. A careful search of the literature will show only a moderate consideration of the fractures of this bone, and almost none of its other pathological conditions.

Fractures of the hyoid bone are of very exceptional occurrence, and are usually produced by a direct blow or fall, or by lateral compression, as by the pressure of an adversary's hand on the throat, and in a few cases by muscular contraction. It is also well known that the bone is sometimes fractured by judicial, but not by suicidal hanging. The fracture is usually that of one of the greater cornua, but occasionally the body of the bone has been broken and fracture of both cornua has been observed. As the bone is usually broken by throttling, the right cornu is the part most often fractured, owing to the pressure of the right thumb of the assailant.

The symptoms are generally quite characteristic; the patient usually feels a distinct snap, or sensation of a solid body giving way in the upper part of the neck, with severe pain, difficulty in speaking, swallowing or even in breathing, and cough. Increased mobility of the parts may be elicited, and sometimes crepitus. The fragments may be driven inwards and perforate the mucous membrane of the pharnyx and cause bleeding from the mouth. Swelling and ecchymosis may occur externally, and a finger introduced into the pharynx may feel the ends of the broken bone. The injury is serious from its accompanying complications, and death has followed in several

* Read before the Southern Surgical and Gynæcological Association, December 11–13, 1906.

instances, but if life is preserved, bony union usually takes place. I have a well marked example of fracture of the hyoid bone with bony repair, in my collection, obtained from a cadaver (Fig. 1).

The treatment is directed more towards relieving the threatening symptoms than towards the fracture. If there is severe dyspnœa, a tracheotomy may be required; if dysphagia, the patient must be fed for many days through a tube, or by rectal enemata. Silence must be enjoined and all movements of the tongue prohibited. The fragments may be replaced by pressure with the finger in the pharynx, and counter pressure from without, and the head should be immobilized in the extended or flexed position, as is most comfortable to the patient and most effective in preserving reduction. If apposition cannot be maintained, I do not see any objection to suturing the fragments together. At times an abscess forms and a sequestrum may be thrown off. Occasionally the voice is changed for a long time, or permanently.

Inflammations of the hyoid bone may result from external violence or from constitutional disease, and usually begins as a periostitis, with localized pain, swelling, dysphagia and dyspnœa. Suppuration generally occurs, and if the pus is not promptly evacuated it may burrow in many directions, and cause extensive havoc. Necrosis of the bone is likely to occur in such conditions, usually limited in extent, though the whole bone has been known to die and be cast off. After the extrusion of the sequestrum, the functions of the bone appear to be but little affected.

Neoplasms of the hyoid bone are of great infrequency, and I have only been able to find five or six cases reported in the literature that is accessible to me.

In most of the works on surgery which I have been able to consult, no mention is made of tumors of the hyoid bone at all, and the references to the subject in the literature are exceedingly sparse. A writer in von Bergmann's Surgery, American edition, 1904, page 38, says, that only two cases of primary tumor of the hyoid bone are recorded in all litera-

FIG. 1.—Fracture of great cornu of hyoid bone.

ture. The occurrence of neoplasms of the hyoid bone, both primary and secondary, is without doubt of great rarity, but I have been able to collect five or six cases, inclusive of one of my own, which I will report briefly at this time.

CASE I.—*Enchondroma of the hyoid bone,* reported by E. Boekel in the *Gazette de Strasbourg,* in 1862, with the remark that it "is unique in literature."

"A woman, 50 years of age, observed in 1859 a tumor on the right side of the throat, which gradually increased in size. The neoplasm was the size of two fists, fluctuating, and hard at its base like cartilage. It raised up the inner head of the sterno-cleido-mastoid and pressed against the larynx, then extended under the chin and terminated in a blunt point 2 cm. below the sterno-clavicular articulation. It was somewhat movable, and the skin was not adherent to the growth. The thyroid gland was small and not involved. Swallowing solids was very difficult, but respiration was not impeded. On puncture of the tumor several grams of liquid jelly escaped. There was no pain. Extirpation was done, and the growth was found to arise from the horn of the hyoid bone, which was resected and the tumor easily removed. There was very slight bleeding. The growth was 12 cm. long and 7 cm. thick. It rose from the periosteum of the horn of the hyoid bone, and consisted of hyaline cartilage with a great number of cells. The patient did well until the fourth day, when secondary hæmorrhage set in, and notwithstanding the ligature of both the external, and, later, common carotid artery, she died of anæmia and exhaustion."

This case is quoted by Dr. J. Spisharny, of Moscow, in the *Deutsche medicinische Wochenschrift,* vol. xviii, p. 853, 1892.

CASE II.—*Tumor springing from the horn of the hyoid bone, causing suffocation through lateral compression of the epiglottis.* "On November 5, 1867, a man, aged 23, appeared, of fair and delicate complexion, who spoke in a very guttural manner, as if his mouth was full of food. Six months previously his voice had become affected, commencing with a cold and sore throat. A swelling formed on the left side of the neck, which affected speech and swallowing, with dyspnœa at times, especially at night, and sometimes a little cough. He could swallow solids and liquids, but as the tumor increased in size this varied, and he became thinner. His previous health had been excellent. He became very weak, with a feeble pulse. The fauces appeared healthy. By laryngoscopic examination a rounded tumor the size of a large walnut was seen on the left side of the throat at the root of the tongue and pushing the epiglottis to the right and compressing the epiglottis laterally, so that it looked as if folded in two. The entrance to the larynx was obstructed. The tumor appeared somewhat ulcerated, and was hard, but not painful. In the neck externally there was a swelling above the thyroid cartilage and connected with the left horn of the hyoid bone. It had increased in size somewhat rapidly of late. No operation was done and the man returned home,

where he died suddenly on November 9, 1867. The growth was supposed to be malignant, but no microscopic examination was made."

Reported by Sir G. Duncan Gibb in the Transactions of the Pathological Society of London, vol. xix, p. 59, 1868.

CASE III.—*Primary enchondroma springing from the great horn of the hyoid bone. Excision and recovery.* "On March 22, 1891, a man, 25 years old, came under observation. On the right side of the throat, immediately below the lower jaw, in the location of the hyoid bone, was a tumor the size and form of a hen's egg. The skin was not altered, and was movable. The tumor was rough, hard and but slightly movable, and was connected with the right horn of the hyoid bone and followed the movements of this bone. It was not painful. The thyroid cartilage was pushed to the left of the middle line. The orifice of the larynx could not be seen, but a lump the size of a walnut could be felt at the base of the tongue, which was rough, hard and but little movable, and was connected with the growth in the throat. The corresponding tonsil was swollen. A laryngoscopic examination was impossible. Swallowing solids was difficult, the voice hoarse, and respiration labored when he was on his back. The respirations were 26 to the minute. The patient was well nourished and the other organs normal. Eleven years ago he noticed that his voice was hoarse. No lump was observed at that time, but five years later the swelling was noticed and grew slowly. Five months before coming to the clinic he began to have dysphagia, and marked hoarseness of voice. On April 10, 1891, under narcosis, Professor Sklifosowsky operated in the following manner: An incision was made at the level of the angle of the mouth and extended in a curved manner to the cricoid, the sterno-mastoid, and vessels pulled outwards and the growth enucleated, when it was seen that it had developed from the right horn of the hyoid bone. Releasing the growth was not easy, and was accomplished by blunt dissection with the index finger. The bleeding was slight. Only the facial, lingual, and a few small vessels were ligated. The right horn was excised at its junction with the body of the bone. He was discharged well in a month. After the operation the temperature remained normal, the voice became clear, and the breathing and swallowing perfect. The tumor was iregularly oval in shape, length 7 cm., breadth 6 cm., and thickness 4½ cm. The structure was mostly hyaline cartilage, rich in cells, and the tumor surrounded with a connective-tissue capsule."

Reported by Dr. J. Spisharny, *Deutsche med. Wochenschrift,* vol. xviii, p. 853, 1892.

CASE IV.—*Mixed round and spindle-celled sarcoma of the hyoid bone. Recovery.* "The patient was a negro, aged 24 years, married, waiter. No family history of malignancy but of tuberculosis. Has had gonorrhœa, but not syphilis. There was a lump the size of an English walnut beneath the chin. The skin was stretched and ulcerated at one point; the larynx was not involved. The tumor is away from the median line and upon the right greater cornu of the hyoid bone. It has been growing for five months, and has been painful one month, and is now very tender. Deglutition and respiration are interfered with. Chloroform anæsthesia.

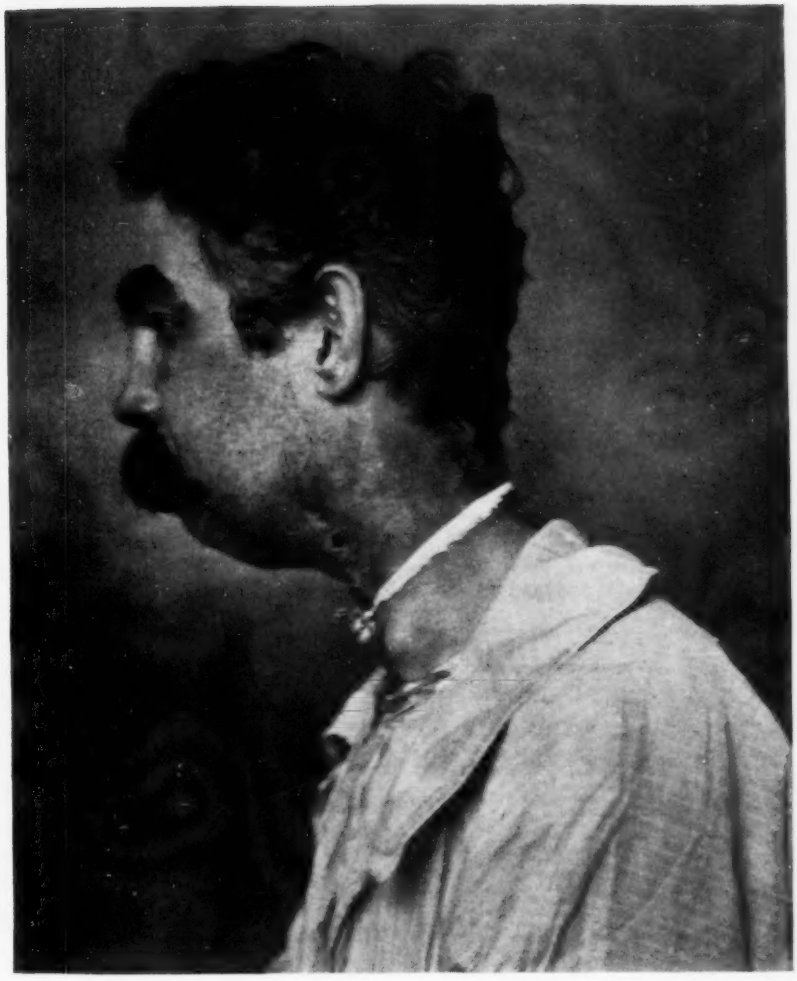

FIG. 2.—Total extirpation of hyoid bone, base of tongue, larynx and part of pharynx for sarcoma. 1906. Recurrence.

Operation on April 7, 1898. Dr. Dawbarn excised the left external carotid artery. Ten days later the right carotid was excised, and the growth ablated. The tumor was encapsulated and easily removed. It was attached to the greater horn of the hyoid bone, and one-half of the hyoid was removed. The mouth was not opened, nor was the thyro-hyoid membrane torn. Some suppuration occurred, but the man recovered and resumed work."

Prize essay by Dr. R. H. M. Dawbarn, "The Treatment of Certain Malignant Growths by Excision of the External Carotids," page 33.

CASE V.—*Sarcoma of the hyoid bone and larynx, with excision of the tumor of the hyoid, base of the tongue, larynx and part of the pharynx, under local anæsthesia.* Case of Dr. R. WINSLOW. (Fig. 2.) On January 9, 1906, Joseph Ward, age 45, white, tailor by occupation, was admitted to the University Hospital, having been sent in from the nose and throat dispensary, where he was examined by Professor John R. Winslow. He was at that time suffering from dyspnœa, due to a growth in the region of the hyoid bone, which so pressed on the epiglottis and larynx as to produce difficult respiration, and to prevent a laryngoscopic examination of the air passages. The diagnosis was tumor of the hyoid bone, involving the larynx. The patient is married and has four healthy children. His parents lived to a good old age, and he does not know the cause of death of either of them. He has had the usual diseases of childhood, as well as small-pox, and 16 years ago had a sore on the penis with suppurating inguinal glands, but this was not followed by any secondary symptoms. Thirteen years ago he noticed a small lump in the left side of the neck, which was excised by Professor W. W. Keen at the Jefferson Hospital, Philadelphia. Through the kindness of Professor Keen the following history has been obtained:

"Ward, Joseph, age 34, was admitted to the Jefferson Hospital on March 31, 1893; discharged April 6, 1893. He had a tumor in the right side of the neck the size of a hulled walnut. He complained of no pain or any other symptom. The presence of the tumor was the only physical sign. There was no family history of tuberculosis or malignant disease. The tumor was removed by Dr. W. W. Keen, April 1, 1893. He found it attached to the hyoid bone and the side of the larynx. Five days later the patient left the hospital with the wound entirely healed."

No pathological examination of the growth was recorded.

This history is probably erroneous in stating the tumor to have been located on the right side, as there was a well-defined scar on the left side of the neck and none on the right, and the patient said the growth was on the left side. He had been a regular drinker, but, he says, never to excess. After the removal of the growth mentioned above he enjoyed good health for three years, when he noticed a recurrence, and it has been increasing in size slowly ever since. About five weeks before admission to hospital the respiration began to be interfered with and there was some difficulty in deglutition. His voice is altered and he has some cough. He is pale, emaciated, and weak. There is marked dyspnœa, with stridor, which makes an examination of the chest difficult. The heart is exceedingly feeble and beats from 110 to 140 times a minute. The apex beat is not visible or palpable, but the heart sounds are clear and the second aortic sound is accentuated. The abdomen presents nothing of importance. There is a large swelling occupying the location of the hyoid bone and extending more towards the left than the right side of the neck. The enlargement is globular, as large as a goose's egg, hard, and freely movable. It is not painful, but causes discomfort. The Adam's apple can be seen and felt below the tumor, and the larynx is not enlarged or displaced. A skiagraphic picture fails to show the hyoid bone, but a shadow of a growth is faintly seen in the area between the jaw and the larynx.

On January 11 his respiration had become so impeded that immediate relief was demanded, and a laryngotomy in the cricothyroid space was done, under cocaine. This relieved his dyspnœa and rendered him much more comfortable. He was desirous of having the growth removed, but his condition did not justify such a serious procedure. He was therefore put on tonics, with digitalis, and fed well, and his pulse gradually increased in strength and diminished in frequency, ranging from 70 to 100 per minute, but still of very poor volume. As he still wished to be operated on, it was thought unwise to place him under a general anæsthetic, hence he was given one ounce of whiskey every hour by mouth from three to eight A.M., and morphia, grain one-quarter, and scopolamin, grain one one-hundredth, one-half hour previous to operation, and infiltration anæsthesia of the skin with Schleich's solution was effected. On February 1, 1906, he was properly prepared, and while still awake the operation was under-

taken and completed. The tumor of the hyoid was first removed with a part of the base of the tongue, when it was seen that the larynx was also involved. The incision was therefore extended downwards in the middle line, the skin reflected, and the whole larynx easily removed without hæmorrhage. The end of the trachea was brought out at a lower level and sutured to the skin. A large gap was left, leaving a wide opening into the pharynx. The pharynx was sutured to the base of the tongue and closed in the middle line so as to make a funnel-shaped canal, and the skin was loosely sutured. The patient stood the operation very well, complained of but little pain, and was in as good condition at its close as at its beginning. I am confident he would not have survived a general anæsthetic. He was returned to bed and put in an almost upright position to facilitate the swallowing of the saliva, and a tracheal tube was kept in the trachea. At first a large soft rubber catheter was passed from the mouth into the œsophagus and water and milk allowed to run into the stomach. but subsequently the lower part of the pharynx opened and the tube was passed into the œsophagus from the neck. There was a free discharge of saliva from the opening in the neck, which was kept from entering the trachea by wrapping the tracheal tube with gauze. The incisions healed promptly except a small place at the bottom, and the patient gained in strength. Three quarts of milk, with eggs and whiskey, were administered daily. He soon sat up and walked around the ward, and in a measure enjoyed life, but in the latter part of March there was a recurrence in the lower portion of the neck, as well as in situ, and he gradually failed and died on March 27.

The tumor was a round-celled sarcoma. A few injections of Coley's mixed toxines were given, as well as X-ray treatments, without benefit. The autopsy showed extensive metastases in the lungs, bronchial glands, liver, and mesenteric glands as well as in the tissues of the neck. I regard this case as a primary sarcoma of the hyoid bone, subsequently extending to the larynx, but of this there is doubt. Professor Hirsh, who examined the tumor of the hyoid, not finding any myeloid cells, is inclined to think the starting point was in the epiglottis.

The hyoid bone was completely destroyed by the growth, only some calcareous particle remaining, while the epiglottis was not entirely destroyed, nor was the larynx as much involved as

one would expect if the growth had originated in the epiglottis. The patient said the growth began to recur three years after the removal of the tumor by Dr. Keen, approximately 10 years ago.

CASE VI.—*Osteoma of the right horn of the hyoid bone,* reported by Dr. John C. Warren, "Surgical Observations on Tumors," page 117. The patient was a man who applied to his father, Dr. John Warren, on account of a lump in his neck. This was a conical exostosis of the right horn of the hyoid bone, nearly three inches in length. This was excised and the man recovered.

Even secondary growths of the hyoid are of great rarity, but Spisharny mentions one case, in which Peter found a metastasis in the body of the bone, at the autopsy of a person who died of cancer of the œsophagus.

Tumors of the hyoid bone, as far as they have been reported, have been either sarcoma, enchondroma, or osteoma, and doubtless this bone is subject to all the neoplasms that are found in the other bones of the body, though with great infrequency.

In the cases tabulated the ages varied from 23 to 50 years of age, and five of the six occurred in men. The length of time intervening between the first observation of the tumor and the removal of the growth, or death of the patient, varied from five months to thirteen years. The growth also varied in size, having been the size of two fists in an enchondroma, goose's egg, hen's egg, conical osteoma three inches in length, and an English walnut.

Deglutition was affected generally, and respiration more or less embarrassed. The voice was altered in nearly all cases, and pain or discomfort was generally present. Cough was also present in some cases. Of the six cases five were subjected to operation with four operative recoveries and one death from secondary hæmorrhage. One case succumbed eleven weeks after the operation from local and general metastases, and one died suddenly without operation, probably from asphyxia, as the larynx was compressed by the growth.

The treatment of tumors of the hyoid bone, whether benign or malignant, should be thorough removal, at as early

a period as possible, with as much of the contiguous tissues as may be necessary. The extirpation of this bone, even when it becomes necessary to excise the larynx and other contiguous tissues, is not attended with extraordinary danger, and the possibility of a permanent cure in malignant cases depends upon an early and radical operation.

SYMPTOMS AND SIGNS IN URINARY LITHIASIS.

BY CHARLES LESTER LEONARD, M.D.,

OF PHILADELPHIA.

As the result of the greater diagnostic accuracy obtainable by the Röntgen method in calculous nephritis and ureteritis, a more exact differentiation is possible between the symptoms and signs of these conditions. It is, however, impossible to differentiate them with precision from intra- and extra-ureteral and renal conditions without the aid of the Röntgen diagnosis.

It is not the purpose of this paper to discuss the symptomatology of these other conditions, but to point out the differences in symptoms and signs between renal and ureteral lithiasis that have a bearing upon the indications for treatment, after the size and position of the calculus has been determined by the Röntgen method. In addition, brief mention will be made of other renal conditions in which aid in diagnosis can be expected from this method in favorable cases.

This study is particularly valuable, since such additional knowledge has formed the basis for new indications for treatment which are in a great part based upon the symptom-complex presented. These symptoms and signs are best studied by discussing the atypical symptomatology, and attention can be confined chiefly to those particularly indicative symptoms that materially assist in differentiating between ureteral and renal colic, and characterize the different stages in the progress of a calculus from the renal pelvis to the bladder.

This study has for its basis my series of 352 cases examined by the Röntgen rays for suspected calculus, and particularly the 71 cases in which a calculus has been diagnosed and the diagnosis confirmed by the recovery of the calculus either at operation or when it was subsequently passed.

The differentiation between ureteral and renal colic can-

not be approximated in possibly more than half the cases by the study of symptoms and signs alone. There are, however, certain symptoms and groups of symptoms which, if only in a measure definite, suffice to form accurate indications for treatment, when taken in conjunction with the findings of the Röntgen diagnosis. That they are sufficient and of value as determining factors is evidenced by the passage of calculi in 31 cases where the expectant treatment had been based upon these indications.

The symptoms and signs cannot alone form the basis for rational treatment, as they do not comprise all the accurate knowledge that can be obtained of these conditions. On the other hand, the Röntgen diagnosis, though accurate and explicit as to the size, number and location of the calculi, does not form of itself a sufficient indication for operative removal of the stone. The symptoms and signs must in addition, and in conjunction with the Röntgen diagnosis, show that the calculus endangers the functional efficiency of the kidney or ureter, and that it is improbable that it will pass by the natural channels.

In the early days of Röntgen diagnosis much meddlesome and unwarranted surgery was done in removing sterile and harmless bodies from the tissues. In a like manner the surgical removal of some calculi would be meddlesome surgery. The Röntgen diagnosis is accurate, but should not of itself form an indication for operative removal of a calculus. The effect of the calculus upon the kidney and ureter should first be considered, and this effect, as expressed in symptoms and signs, is therefore of value in determining the indications for treatment.

In addition to the value in determining the indications for treatment, the study of the symptoms and signs is valuable in suggesting the possible presence of stone in obscure cases, and that a calculus should be detected or excluded. There are many cases in which the symptom-complex points to the presence and progress of a calculus down the ureter, but where the symptoms have suddenly ceased and even the urine may have become absolutely normal.

It is essential to the integrity of the kidney to determine whether a calculus is present and has become quiescent or occlusive, or has passed into or out of the bladder without being detected. The symptoms subside in either case and yet, if the calculus remains quiescent it may form the locus about which irritation and infection take place; if it is occlusive, a hydronephrosis results and the functional life of the kidney is threatened, as the cessation of activity means final atrophy and degeneration. If, on the other hand, it is detected in the ureter the indications for treatment will depend upon its size and the progress of the symptoms and signs, while if it is shown to have passed or to be absent from the urinary tract no treatment is required.

There is little actually known regarding the causation or method of formation of stone, and yet many factors must be properly adjusted to each other, or the normal individual would be more liable to stone formation. Mr. Reginald Harrison has pointed out that if a normal man were to void only half the 10 grains of uric acid usually excreted in a day, by the concretion of the remainder he could in forty-eight days form a stone weighing not less than half an ounce. He says: "If the production of stone were dependent upon a single link rather than upon a chain of them, it is probable that these disorders would be far more common and general than they actually are."

It may be said in addition that stones are probably much more frequently formed than one might be led to suppose by the number of cases presenting themselves for examination. This has been illustrated in a manner by the greater frequency of ureteral as compared with renal stone, since a more accurate means has been determined for finding them and a more definite knowledge of their symptoms has led to a suspicion of their presence.

All ureteral calculi probably form in the pelvis of the kidney and many undoubtedly pass without giving rise to suspicious or severe symptoms.

The symptoms and signs of calculous conditions in the kidney and ureter are due to irritation produced by their pres-

ence, to injury which they inflict in their passage or movements, or to obstruction of function. The severity of the symptoms is often in inverse ratio to their size but proportionate to the extent to which they interfere with the function of the kidney.

In nephrolithiasis, the symptoms and signs, when due to the irritation produced by the calculus acting as a sterile foreign body, are very slight unless partial or temporary occlusion is produced. A lumbar ache, increased by exertion, with a constant but small amount of albumin, has been observed in these cases. Sometimes the calculus has been very large and the albumin has persisted for eight or ten years or longer; or it may be entirely imbedded in the tissues, or enclosed in a cyst or occluded calyx. Where the calculus is rough and adhesions are present, sharp pain may have been experienced and blood is often found in the urine. The movable renal calculus of medium size produces the most characteristic and intense symptoms, with blood, if it is rough, or accompanied by pus if infection is added. The intense agony and pain of renal colic, with its quick onset without prodromes, and its almost as sudden relief, are characteristic of obstruction of the hilum. It is the classical stone in the kidney, with pain radiating often in all directions from the kidney, down the ureter to the groin, the testicle and the thigh. Temporary obstruction and mild attacks of colic have been produced by the passage of blood clots and muco-purulent plugs. When infection has been present for some time there is an absence of all acute symptoms, a dull ache in the lumbar region and pus and earthy phosphates in the urine persisting.

The most constant signs in the obscure cases are a small constant amount of albumin or traces of blood, accompanied by a constant dull ache or sense of discomfort in the renal region. Palpation is of little diagnostic value unless a large, sterile stone is present without obstruction, when tenderness may be elicited if the pelvis of the kidney can be reached. Hydro- and pyo-nephrotic kidneys can be palpated, but the information gained is only confirmatory of more obvious symptoms except where complete obstruction is present. The pres-

ence of a constant lumbar ache, with persistent albuminurea of mild degree with an absence of any history of acute attacks of colic should always suggest the possible presence of a quiescent sterile renal calculus. This suspicion would be increased if there was a trace of blood found from time to time in the urine. There have been three cases of this character among those studied. In them fixed or encysted calculi of large size have been found, one calculus measuring over 2½ inches.

It is particularly difficult during the first attack of colic to differentiate a calculus that enters the hilum of the kidney and blocks it, but does not enter the ureter, from the small calculus that has entered the ureter and can safely be allowed to pass into the bladder. The differentiation between renal and ureteral colic and the indications for treatment will be discussed after the review of the symptoms of ureteral lithiasis. As has been said, the irritation and obstruction produced by the calculus during its passage through the ureter are responsible for the symptomatology.

There is a wide range in the severity of these symptoms, depending upon the degree of irritation and the completeness and point at which the obstruction takes place, the size and character of the calculus bearing an evident relation. The symptoms are so clearly subdivided by the point at which the obstruction takes place that they will be studied according to this subdivision. The most common seat of impaction has been the uretero-iliac junction, and the second that point in the juxta-vesical portion of the ureter where it enters the wall of the bladder. The portion above and the portion below the uretero-iliac junction exhibit symptoms that are distinct and characteristic of their involvement, though in some cases there has been a merging of the one into the other. In general it may be said that the symptoms of calculus approximate those of renal lithiasis when the upper portion of the ureter is involved, while vesical calculus is so closely similated by calculous involvement of the lower portion that in more than one of these cases the bladder had been opened and explored for stone.

In the upper portion of the ureter the seats of impaction

of calculi are at the uretero-iliac junction, where the ureter bends and is flattened in crossing the artery, and at a point of narrowing about an inch below the lower pole of the kidney. This latter point is where the larger calculi that pass from the kidney may become lodged and are then liable to give rise to acute symptoms of obstruction. These are the calculi that more frequently demand operative removal. The smaller calculi, since they produce less marked symptoms, are more difficult to detect and are often more dangerous on this account. They may cause complete obstruction with very few or no marked symptoms, or may even, when no larger than a grape seed, cause intense and acute paroxysms of pain, with hæmorrhage out of all proportion to their size. It is in the insidious attacks with few or masked symptoms that an exact knowledge of the position, size and location of the calculus is most essential to the safety of the patient. These cases have little danger so soon as the exact size and location of the calculus has been determined, and the presence of a bilateral urinary flow, with a normal excretion of urea established. The frank, open cases, with severe attacks of pain, lose their grave aspect when it is known that the calculus is small enough to pass and what its exact position is in the ureter. A previous history of a series of attacks increasing in frequency, after the exact diagnosis has been established, means in such cases that natural forces are working and are competent to finally expel the calculus. Each attack can then be welcomed as an evidence of continued activity and each as a step nearer permanent relief.

Occlusion generally precedes the onward movement of a calculus in the ureter. By obstructing the urinary flow it produces distention of the ureter and pelvis of the kidney. These, in contracting, produce the force which dilates the ureter at the seat of the calculus impaction, and pushes it onward. This process is slow and gradual and gives rise to symptoms that extend over long periods. There may be a constant lumbar ache that persists between attacks, with an increasing ache and discomfort, prodromal in character, during the distention of the ureter. The acute attack of ureteral colic following it,

and subsiding after the calculus has been pushed along or the urine has escaped around it. This flush-tank variety of hydronephrosis is characteristic of these attacks, but may also be caused by an interference with the urinary flow, as by twists or valves in the ureter.

The history of a calculus passing down the ureter is characteristic. Attacks increasing in frequency and generally in severity should lead to the suspicion of a quiescent calculus that occasionally produces obstruction and may or may not be passed, depending on its size, and its location in successive attacks. The attacks may not be identical in symptomatology, but a sufficient number of the symptoms are repeated to establish their identity, while the lumbar ache and discomfort precedes and follows each attack, becoming continuous as they come closer together.

Beside this prodomal lumbar ache that persists and subsides gradually after the sharp colic attack, ureteral lithiasis is characterized by the radiation of the pain. In the crisis of the acute colic there is generally a point in the line of the ureter from which the pain seems to shoot upward into the kidney and downward along the distribution of the genito-crural nerve. The point of greatest intensity is frequently over the seat of obstruction, and when the upper portion of the ureter near the kidney is involved the pain is accompanied by nausea and vomiting. This is more liable to occur when there is complete occlusion. The distribution of the pain differs from that of renal calculus in that it does not radiate around the body, and from that of calculus in the juxta-vesical portion of the ureter in that it does not approximate that of vesical stone. That is to say, the pain is felt in the scrotum, testicle or labium major, and down the thigh, and in the groin. It does not involve the glans penis, the urethra or the meatus urinarius. In addition to the pain, stone in the upper ureter often produces a reflex contraction of the psoas muscle, due apparently to irritation. There is found to be a characteristic tendency to flex the thigh upon the body in these cases and an unwillingness to extend it, even after the acute attack of pain has subsided.

Palpation in these cases often yields valuable results. While the ureter can be palpated and its thickened and tender condition noted, in other forms of chronic ureteritis, in calculus ureteritis it is often possible, not only to detect and palpate the distended ureter, but also to locate an exquisitely tender point, and even to feel the calculus. To palpate a calculus impacted at the uretero-iliac junction, the patient should lie with limbs extended. The bifurcation of the aorta into the common iliacs should then be found and the finger carried along the common iliac artery 1½ to 2 inches. The pulsation of the iliac can often be felt, and if a calculus is present an intensely tender spot sharply localized will be encountered. This tenderness has been confused with that of an inflamed appendix, or a displaced and inflamed ovary, and these organs have been removed in some cases in which a calculus was subsequently found and removed from the ureter. The ureter may or may not be found distended above the calculus as a hydro-ureter, when distended as the result of occlusion the similarity to an inflamed appendix is more marked. Palpation is also of value when calculi lie low down in the juxta-vesical portion of the ureter, where they can be felt through the rectum or vagina.

The most characteristic sign of ureteral stone, especially the freely movable or small rough calculi, is repeated traces of fresh blood in the urine. This sign may, however, be entirely wanting if the calculus has been quiescent. Where obstruction has been present, sufficient to produce backward pressure upon the kidney, albumin may be found. When complete occlusion has taken place the urine may be perfectly normal, since it may come from but one kidney, but the daily amount of urea excreted may be too low. Infection and pus in ureteral lithiasis have accompanied calculi lodged just below the kidney or just outside the bladder, and has been sufficiently intense, with such grave acute symptoms as to demand immediate operation. In these instances the accurate localization facilitated and was confirmed by the operation.

The symptoms of calculus in the juxta-vesical portion of the ureter differ distinctly from those of calculus at or above

the uretero-iliac junction. The signs are nearly identical, though there is less liability to blood in the urine, and more chance of infection. There is often a history of previous attacks one, two, three or more years, or as many months, apart, with an increasing frequency during the last year or six months. The point of acute pain will be found, in a calculus that is passing down the ureter, to be gradually lower and will usually mark the points where impaction is most frequent. There is often a sense of fulness in the renal region, the result of an hydronephrosis of either passive or flush-tank variety. This is more common with calculus impacted at the uretero-iliac junction, while infection is more liable to occur when the impaction is near the bladder and the occlusion is incomplete.

The most noteworthy characteristic of the pain symptomatic of calculus in the juxta-vesical portion of the ureter is the closeness with which it resembles that of vesical or prostatic calculus. The presence of some of the symptoms of ureteral lithiasis and pain ascending to the kidney or down to the thigh should lead to a suspicion of the true cause. The symptoms simulating vesical stone are apparently due to the involvement of the same nerve supply and interference with the vesical trigone. The pain is referred to the glans penis or the meatus in the female and along the line of the urethra. It may be very intense, and is often felt while the bladder is contracting as well as at the end of micturition. Pain in the scrotum and testicle or the labium major, in the groin and the inner side of the thigh, are also often present with pain ascending to the kidney, and, less frequently, a dull lumbar ache.

Acute attacks of colic are more rare, especially if the calculus has been quiescent. Partial occlusion may result in hydro-ureter and hydronephrosis, or these may be combined with infection. Infection may produce very severe symptoms resulting in complete occlusion and often demands immediate operation. In one patient three calculi smaller than grape-seeds, together with infection, produced occlusion which was relieved and the calculi removed by operation at the seat of impaction. In other cases the bladder has been opened and

explored for encysted calculi or has been treated for cystitis when the ureter was the seat of the disease. As in calculus situated above the iliac artery, there is great difficulty in differentiating calculus conditions of this portion of the ureter from extra-ureteral or intra-ureteral conditions. In fact, it is because the similarity in symptomatology is so close and an exact method of diagnosis did not exist, that the Röntgen method is so valuable and has made possible a closer differentiation in the symptomatology.

An exact diagnosis cannot be made without the assistance of the Röntgen method, even with the more definite understanding of the symptoms. Their study is most valuable as confirmatory evidence and in securing data upon which the

The differences in the symptoms of renal and ureteral colic are that the onset and end of the attack are more sudden. Ureteral colic is preceded by a prodromal lumbar ache that becomes more intense until the crisis or acute attack of pain. This lumbar ache subsides by lysis and may not entirely disappear between the colic attacks. The pain is localized at the seat of obstruction in the ureter and radiates upward as well as downward. In the kidney the pain is most acute in the region of that organ and radiates downward or around the body, while if there has been an ache from a quiescent renal calculus, it has not gradually increased in volume, and is generally absent after the attack. In colic due to calculus in the upper ureter there is generally reflex irritation of psoas muscle and contracture, while palpation will detect a distended and tender ureter with an acute point of tenderness at the seat of impaction. The hydronephrotic kidney can be felt sometimes in both conditions, but is fluctuating and of the flush-tank variety in ureteral stone.

In calculus impacted in the juxta-vesical portion of the ureter the symptoms of ureteral calculus are combined with those of vesical stone, with the absence of the psoas reflex and the point of tenderness at the uretero-iliac junction. There is less liability to lumbar-ache and fewer attacks of colic, especially if the calculus has become quiescent.

The previous history of the attacks, with their intervals, is very valuable when the information is given by intelligent persons. With a series of attacks extending over a period of months or years, with a shortening interval between the attacks and pain localized during the acute colic lower and lower down, with at first no lumbar ache and finally a persistent lumbar ache, or ureteral and vesical symptoms intermingled, the picture is complete of the progress of a calculus down the ureter, and it becomes almost certain if to this history and symptoms that are confirmatory is added the presence of occasional traces of blood. But even with so typical a history and the subsidence of symptoms it is impossible to say that a calculus was ever present, or if present that it has not passed undetected.

Such a history, or even a partial history with many symptoms lacking, in the presence of a small stone detected by the Röntgen method, is sufficient evidence upon which to base a rational course of treatment. If the urinalysis shows that a normal amount of urea is being excreted; if the attacks have been intense and if a lumbar-ache persists, there is evidence that nature is attempting to expel the calculus, that the patient is in no immediate danger due to suspension of functional activity, and that the kidney and ureter still possess sufficient contractile power to expel the stone.

If, on the other hand, the calculus is large, and frequently repeated attacks of colic fail to produce any change in its location, or if infection is present, or acute symptoms develop, or the amount of urea becomes persistently low, the indications for the immediate removal of the calculus are present.

The detection of a large calculus in the kidney is an indication for operation unless the calculus is producing but few symptoms and the age of the patient or any physical disability makes the operative risk grave.

A small calculus in the kidney without complications, where there has been but one or two colic attacks, may be permitted to remain, as they are frequently passed, one patient passing a small calculus from the kidney and out of the bladder on the day set for operation.

The tolerance of the kidney and ureter for small sterile calculi is so fully demonstrated by many cases that have passed numerous calculi in series, that the detection of a calculus is not an indication in itself for operation. Multiple calculi either in both ureters or in the kidney and ureter are indications for primary operative removal of the calculus in the ureter. Multiple calculi detected in one ureter have all been passed in two or more cases. The mortality in ureter-lithotomy is high, especially for calculi situated below the iliac artery, and in the presence of 31 cases of ureteral calculus that have passed the calculi after the patients were put upon the expectant treatment, operation seems to be justified only in the advent of acute symptoms, or where both urinary tracts are involved.

As I have said in a former paper (*The Lancet,* London, June 17, 1905) " While the presence of an undetected calculus may be a grave danger and a menace to the integrity of the kidney, as soon as its exact size and location are known that menace cease, unless there are symptoms present that indicate a progressive impairment of the function of the kidney. Comparatively few migrating calculi give rise to anuria, or a greater proportion of patients suffering from ureteral stone would die."

With the knowledge that so many patients pass calculi, and an accurate method of determining their size and location, it is rational therapy to permit nature to accomplish that which she has accomplished in a large number of cases.

Because of the exact knowledge obtainable the patient's safety can be guarded during such expectant treatment and operation can be directed to the seat of obstruction if it is needed. It is, however, irrational to operate because a calculus has been detected unless it threatens the integrity and functional life of the kidney.

Although the same accuracy and detail have not been obtained in other pathologic conditions of the kidney, much that is valuable and assists materially in diagnosis can be secured in favorable cases. Thus displacements, hydro- and pyo-nephroses and hypertrophies of the kidney have been

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Although the same accuracy and detail have not been obtained in other pathologic conditions of the kidney, much that is valuable and assists materially in diagnosis can be secured in favorable cases. Thus displacements, hydro- and pyo-nephroses and hypertrophies of the kidney have been

demonstrated. Pus or debris filling the pelvis of the kidney have been detected and the pus has been washed out through the use of the ureteral catheter. Cysts external to the kidney and gross collections of pus in the cortex, as well as the more marked surgical kidney, have been recognized. These refinements in diagnosis can be obtained only in favorable cases and by careful study of the negatives. It is not always possible to determine or distinguish one condition from another, and yet there is absolute evidence to the expert observer of a pathological condition.

In closing, it is perhaps worthy of note that in none of the 352 cases examined for a diseased condition of the kidney, has any deleterious effect been observed as the result of the examination, with the exception of some cases of dermatitis among the earlier cases. No dermatitis has occurred during the past four years. The innocuousness of Röntgen examinations is apparently demonstrated by these cases with renal disease and the thousands of other cases examined without harmful results.

TUBERCULOSIS OF THE BLADDER.

BY GEORGE WALKER, M.D.,

OF BALTIMORE,

Associate in Surgery in the Johns Hopkins Hosptial.

(Concluded from page 408.)

PART III.

RESULTS.

In 477 cases, results of treatment were given. In 44 of these the statements were so indefinite that they were rejected from the following list:

Deaths	161	Cured	29
Improved	130	Made worse	6
Not improved	77	(Indefinite)	44

Deaths.—In the 161 deaths, there were 49 cases in which an operation of some kind had been performed; in 7 of these death was directly due to operative interference, in 42 it occurred at a remote period. The operations in the fatal cases were as follows: 28 suprapubic cystostomies, with curetting, cauterization with the Pacquelin cautery, excision of ulcer, etc.; 10 perineal sections; 5 nephrectomies; 3 prostatectomies; 2 nephrotomies; 1 vesico-vaginal incision. Of the 7 deaths which were due to operative interference (these are included in the above list) 3 followed a perineal section; 2 excision of the diseased area; 1 suprapubic cystostomy; in 1 the cause was not clearly stated. It is probable that there were more fatalities, but only those cases have been selected in which death occurred within the first few days after operation.

The cause of death in the great majority was not specifically stated; 4 patients died in coma; 2 from acute miliary tuberculosis; others from general tuberculosis, exhaustion, suppression of urine and other complications.

Improvement,—130 patients are said to have improved—

some only slightly, others markedly so, and a few were almost cured. Among the procedures employed were 48 suprapubic cystotomies; 23 iodoform injections; 18 sublimate instillations; 10 medical treatments; 5 curettings through the urethra in females; 5 perineal sections; 4 instillations of gemol; 3 vesico-vaginal incisions; 2 changes of climate; 2 excisions of the ulcer; 2 injections of tuberculin, 2 nephrectomies; 1 cauterization through the urethra in the male; 1 guiacol injections, and 1 vesico-vaginal incision with suprapubic cystotomy.

The average age of the improved patients was 31.02 years.

No Improvement.—There were 77 cases in which in spite of treatment no benefit followed. Among the procedures employed were 34 suprapubic cystotomies; 15 instillations of sublimate; 10 curettings of the bladder through the urethra in females; 7 instillations of iodoform; 3 irrigations; 2 instillations of gemol; 2 perineal sections; 2 medical treatments; 1 excision of the ulcer: 1 suprapubic and perineal section combined. The average age of these patients was 27⅓ years.

Cured.—There were 29 cases reported as cured. In these there were 9 suprapubic cystotomies with curetting, cauterization, iodoform drain, etc. (Bell, Guyon, Routier, Loumeau, Battle, and Carleton); 8 nephrectomies (Albarran, Koenig, Bougle, Kapsammer); 5 changes of climate (Bangs, Cumston, Camero, Desnos); 2 curettings of the bladder through the female urethra, (Polak, Motz); 2 sublimate instillations (Guyon); 1 iodoform injection (Jamin); 1 medical treatment (Richter); 1 nephrectomy with suprapubic cystotomy (Meyer).

Among the cured patients there were 13 males and 10 females; in 6 the sex was not given. The youngest was 11 and the oldest 49. The average age was 28.87 years.

In making up the foregoing list I have aimed to be as fair as possible, but I think I have leaned toward the inclusion of some cases which were doubtful.

A synopsis of a few of the excluded, doubtful, and specially interesting cases is as follows: Mullin's patient is referred to as cured, but at last accounts complained of consid-

erable frequency of urination during the day, which would argue that there must still have been some bladder irritation. It is presumable, therefore, that the disease was still mildly active.

Strauss' case is not one of undoubted tuberculosis, for at no time were tubercle bacilli found in the urine, and the ulcer in the bladder was single and situated on the anterior wall. (Not included.)

Griefenhagen reported a cure after perineal section, but in his last record he says that both cords were still thickened. Such being the case, doubt is thrown on the complete recovery of the bladder. (Not included.)

Clado recorded a cured bladder tuberculosis. The diagnosis was made, however, only on the appearance of the granulations in the bladder at the time of operation. This case is included but is not absolutely positive.

Polak's patient had tubercle bacilli in the urine and the cystoscopic examination showed a tuberculous mucous membrane. This, then, I take to be an undoubted instance of cured bladder tuberculosis.

The tuberculosis in Bangs' record is unquestionable. A perineal section and suprapubic cystotomy were both employed without improvement, after which the patient went to California and was apparently cured.

Cumston gives the clearest and most undoubted example of the list. A girl aged 11 had tubercle bacilli in the urine proved by the microscope and by inoculation into a guinea-pig; there were also typical tuberculous lesions in the bladder which were carefully observed through the cystoscope. She was treated with local applications of lactic acid once a week, and iodoform oil was injected every fourth day. This was kept up for four months, when she was sent to Bermuda and remained there for several months; on her return the bladder was again cystoscoped and the lesions were found to have healed; no tubercle bacilli could be discovered in the urine and inoculation of a guinea-pig proved negative.

Carleton's report, which is included in the above list under

the head of suprapubic cystotomies, is as follows: Male, 39, had had several attacks of hæmaturia; later, frequent and painful micturition developed, and tubercle bacilli were found in the urine. A suprapubic cystotomy was done, a large stone was found and definite tubercles were seen on the mucous membrane. After the operation the patient rapidly improved and the tubercle bacilli disappeared. While it is stated that the organisms were found in the urine, and that definite tubercles were present on the mucous membrane, the bacilli were not differentiated from smegma bacilli and the tissue was not proved to be tuberculous by microscopic examination. Then, too, the symptoms cleared up so rapidly that, taken altogether, there must remain some doubt about this case.

The report of McGrath was not included. In this instance there were no tubercle bacilli in the urine, nor was any tissue of the bladder removed and examined, the diagnosis being made simply on the appearance of the mucous membrane at the time of operation. The bladder was drained for six weeks, and at the end of ten months the urine was clear and the other symptoms had disappeared.

Cotterel's case has been referred to in the literature as an instance of cure. No tubercle bacilli were found in the urine, and there was no tuberculosis, as far as could be made out, in the other genito-urinary organs. The bladder showed a small ragged ulcer just above the right ureter, but otherwise there were no characteristic signs. The mucous membrane was curetted and touched with the Pacquelin cautery; the wound healed readily and the patient became entirely well. (Not included.)

Reynès case is reported as an example of recovery. The author states that the patient was very much improved, but does not say that he was well. (Not included.)

Battle had an undoubted instance which was cured after operation. The patient, a female aged 11, had had various forms of treatment without benefit. A suprapubic cystotomy was done and the bladder was curetted and cauterized with chloride of zinc. She made a slow, but apparently complete

recovery, for at last accounts her health was good; she had no bladder symptoms, and was able to hold her urine for three hours. The tuberculous nature of this case was proved by the examination.

McGowan reports 10 suprapubic cystotomies for tuberculosis of the bladder with 4 cures. The cases said to be cured were never definitely proved to be tuberculous. (Not included.)

Botsford cites an instance of a cure by hypodermic injections of nuclein. (Not included.)

Richter is said to have cured a bladder tuberculosis in a girl by the use of ichthyol administered internally. (Not included.)

Guyon had only 1 suprapubic cystotomy case that was practically well afterwards. (Included.)

Horwitz has seen 2 cases of bladder tuberculosis subside spontaneously. (Not included.)

Personally I have not observed in my practice, nor has there been in the general surgical wards of the Johns Hopkins Hospital a single instance of complete recovery from bladder tuberculosis.

Made Worse.—There were 9 cases recorded as being made worse: 3 from sublimate instillations; 2 from injections of tuberculin; 3 from perineal sections; 1 from injections of guaiacol; and 1 from injections of iodoform. After the instillation of sublimate, in one of the above, there was great increase in the frequency of urination and a rapid implication of the prostate. The average age of the patients who were made worse by treatment was thirty-four years.

Excision of the Diseased Area.—There were 13 instances in which the diseased mucous membrane was excised through a suprapubic opening; 2 of these patients died from the effects of operation; 8 died at a later period; 2 were improved; and 1 was unimproved.

The bladder was completely excised with transplantation of the ureters into the rectum, twice; both patients died some time after.

I wish to thank Dr. Halsted for allowing me to use the

surgical histories and Dr. William McCallum for the privilege of examining the preserved tissues and the autopsy records.

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CIRCUMCISION.—A PLASTIC IN CONSTRICTED PREPUCES.*

BY OSCAR H. ALLIS, M.D.,

OF PHILADELPHIA,

Surgeon to the Presbyterian Hospital.

THE skin covering the penis differs in many respects from the integument in the other parts of the body. It is thin, elastic, has little if any subcutaneous fatty tissue, is loosely connected with the organ it covers, and at the free end of the penis instead of uniting at the terminus, as is the case with the fingers and toes, turns inward and finally becomes attached to the organ just behind the corona glandis. Thus the glans penis gets two layers, or rather two thicknesses, of true skin. This turning in of the skin serves an important function: it presents an epithelial skin surface to the epithelial surface of the glans penis and, as epithelial surfaces do not ordinarily fuse or unite, a permanent opening is left for the urethral canal to discharge the accumulations of the bladder.

The turning-in of the preputial covering must necessarily make the terminus less distensible than other parts, and it is not uncommon to find the preputial orifice narrowed at birth and resisting efforts at retraction. Some years ago my colleague on the staff of the Presbyterian Hospital, Dr. De Forest Willard, called attention to this narrowing of the prepuce and to the presence around the glans of a secretion that required removal. His article directed attention to a much neglected subject and elicited commendation from sources that would have been supposed to be familiar with the subject.

The importance of attention to the cleanliness of the glans penis while the child is in early infancy is not as generally practised as it should be. Between the prepuce and the glans penis there is at birth some inspissated smegma, and this, if

* Read before the Philadelphia Academy of Surgery, January 7, 1907.

permitted to remain, will occasion irritation that will give rise to uneasiness and repeated attacks of non-specific balanitis. Hence, as a result, the inner surface of the prepuce and the glans penis becomes inflamed; the epithelial surfaces are covered with granulations, and ultimately the prepuce becomes adherent to the glans. This in itself would not be the source of further irritation were there not imprisoned the old inspissated smegma. The chief collection of this secretion is back of the corona, where it serves the purpose of perpetual annoyance.

I have seen three types of neglected prepuces in the adult. In one instance there was retention of urine. Dr. Roger Keys asked me to see a young man with retention of urine whose constriction would hardly admit a probe the size of a darning needle. When I entered the house I found him in the act of urinating. He was standing erect, leaning against a wall, and flowing from the penis was a fine spray that shot upward and forward for a distance of six or eight feet; the bladder was relieving itself under spasm. In a second case the glans penis had become adherent to the preputial covering and the most careful dissection could not uncover it. In this case the superficial surface of the prepuce was retracted, but in doing this a raw surface was all that was left for the glans. In a third case, epithelioma had resulted and amputation was necessitated, in a case that I had no reason to suspect an impure life.

In many children a marked redundancy of prepuce will be noticed. There is good reason to believe that this is occasioned by the traction the child makes upon the skin in efforts to relieve irritation. A redundant prepuce may resist retraction, it may be constricted and be as mischievous as the constricted and contracted variety.

Circumcision is relegated by works on operative surgery, and by the profession generally, to the class of minor surgical operations, as if it were a matter of so little consequence that it hardly deserved attention. But practical experience has much to say to the contrary. There is scarcely a surgeon of general practice who has not been called upon to

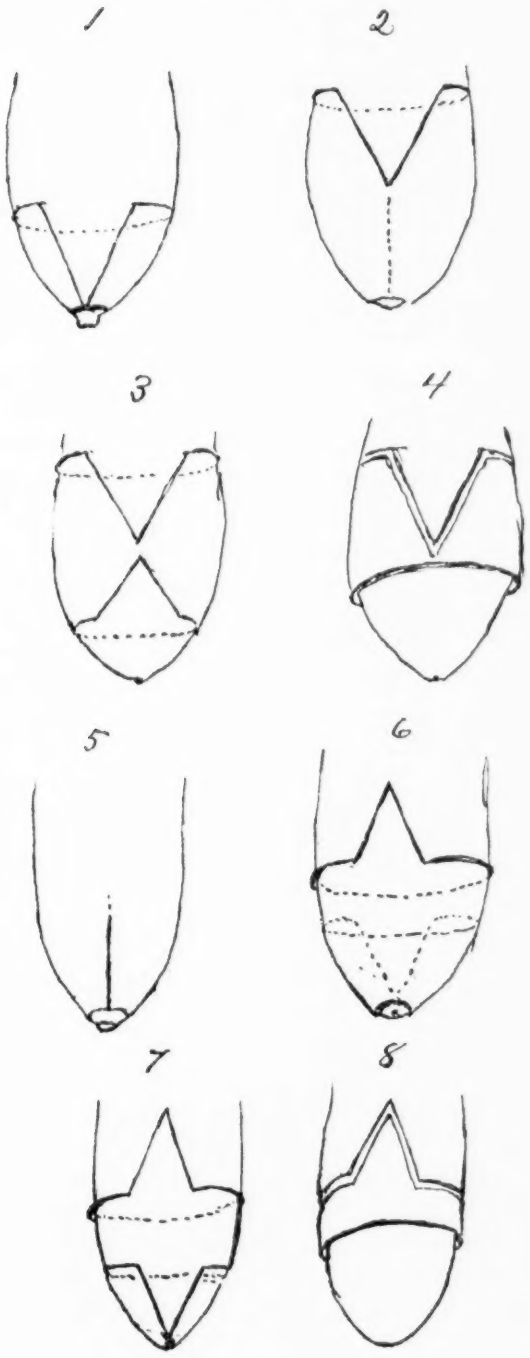
patch up and complete the criminal mutilations of incompetent operators.

An operation that is very widely practised consists in obliquely clasping the prepuce just anterior to the head of the glans, and with a single sweep of the knife removing the redundancy. The outer skin covering is now retracted and the inner mucous one trimmed off near the corona and parallel with it, leaving just enough to easily attach the skin flap. This usually results in a comely appearance. After attaching the two surfaces, I usually carefully test the freedom of the preputial covering and often nick the inner coat at its junction with the glans penis, since the least constriction in the mucous layer is apt to provoke swelling.

In all my early operations and in most of the operations I have witnessed, the glans penis is permanently uncovered. Whether this is the best possible result or not I do not know. One thing only I know, that the glans penis is always covered at birth, and it would seem that a hood that partially if not completely covered the organ, and which could be readily retracted for cleanliness, would be nature's model.

In some cases the prepuce is closely drawn over the head of the organ. In such, a simple splitting of both coverings upon a grooved director, from opening to the corona, yields a very satisfactory result. The dog-ears present at first shrink and leave no trace in after years of their early redundancy. The only objection to this operation is that it leaves the glans permanently uncovered, and it is with a view to preserve the original appearance, viz., partial covering for the glans, and at the same time have a retractable hood, that I have been led to contrive and practise the following operation:

Fig. 1 represents three steps in the operation. *First,* circumcision at the extremity of the prepuce. *Second,* making a V-shaped flap extending from the primary circumcision to a little beyond the greatest circumference of the glans, and, *Third,* carrying the incision from the base of this flap around the organ on dotted line. All of this is done in the outer skin covering. Fig. 2 represents the skin retracted and a dotted line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extending from the point of primary incision upwards. Fig. 3 represents the effect of slitting up the inner or mucous layer. Fig. 4 represents the inner layer retracted and ready for suturing and the half covered glans penis.

The steps of this operation may be reversed, and instead of making the V-shaped flap in the outer skin layer it may be made in the deeper inverted or mucous layer. The chief difference between the two is that the frenum is not approached in the operation just described, while in the second the circumcision of the inner covering may do so.

Fig. 5 represents the glans covered and two steps in the operation, viz., the primary circumcision through the outer skin layer of the prepuce and an incision through it to a point in the greatest circumference of the glans. Fig. 6 represents the skin retracted and a dotted line extending from the preputial opening back, V-shaped, and the same dotted line extending around the glans. Fig. 7 represents the effect of the incision following this line. Fig. 8 represents the inner or mucous layer reflected and ready for suturing.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 9, 1907.

The President, Dr. George Woolsey, in the Chair.

EPITHELIOMA OF THE TONGUE: FOUR YEARS AFTER OPERATION.

Dr. Clarence A. McWilliams presented a woman who was twenty-four years of age when she was admitted to the Presbyterian Hospital, in August, 1902, complaining of a painful lump on the side of the tongue, which she had first noticed three months previously. Pain on chewing was very severe, so that she took only fluids. She had lost much flesh and strength.

Examination showed a hard, superficial lump about the size of a dime, situated on the left edge of the tongue, about 1 inch from its tip. There was no ulceration. It extended just to the dorsum, and impinged very slightly on the mucous membrane of the floor of the mouth, but not as far over as the attachment of the mucous membrane to the lower jaw. The tongue was freely movable. Opposite the lump there was a sharp carious tooth. One gland, the size of a marble, could be felt under the angle of the left jaw. A section which was removed showed flat-celled epithelioma, full of epithelial pearls.

Operation was performed on August 20, 1902, more than four years ago. Under morphin and ether narcosis, a curved incision was made below the jaw, exposing the submaxillary triangle. This flap was dissected up, uncovering the submaxillary gland, which seemed enlarged. The external jugular was divided, and several small lymphatic glands were removed, with all the fatty tissue in the triangle. Under the angle, one gland, about the size

of a marble, was excised. The lingual artery was tied in the usual place. The head was then turned strongly to the right, the mouth held widely open by a mouth-gag, and a stout silk thread transfixed the tongue which was drawn well into view. An incision was then made, widely encircling the growth on the dorsum, and extending deep through the tongue into the muscles on the under surface. The knife, passed from below upwards along the inner surface of the jaw, divided the mucous membrane at its attachment to the jaw. The entire mass was then removed in one piece through the mouth, consisting of a section of the tongue, with the growth, the muscles of the tongue, and the submaxillary and sublingual glands. The hæmorrhage from the raw area was minimal. The raw edges of the tongue were brought together with catgut, excepting for a distance of about 1 inch posteriorly. An inch and a quarter of the left anterior lateral portion of the tongue was removed. Pathological examination of the submaxillary and sublingual glands showed that they were not involved. The lymph gland removed from the angle of the jaw showed that it was affected with epithelioma.

The patient took X-ray exposures to the neck twice a week for one year after the operation. It was now almost four and a half years since the operation, and there were no evidences of a recurrence, although in view of the lymphatic involvement a recurrence had been expected. Whether the X-ray exposures contributed to the result could not be stated, but it was doubtful. The case emphasized the necessity of removing all the lymphatic glands, even in very small and early growths, and brought up the question whether in these cases it was advisable to always remove the glands from *both* sides of the neck even when they were not palpable, or should we limit the removal to the side of the neck on which the growth was situated?

The age of this patient at the time of operation, twenty-four years, was somewhat unusual. Her speech now was practically perfect. Examination showed that the tip of the tongue was drawn to the left, and tightly attached to the jaw.

NEPHRECTOMY FOR HYPERNEPHROMA.

Dr. Charles H. Peck presented a man fifty-three years old, who was operated on for chronic appendicitis about two and a half years ago. His recovery was prompt and uneventful. In

June, 1906, he had right-sided pneumonia and pleurisy, followed by double femoral phlebitis. He was under treatment in a hospital for about seven weeks, and during a part of this time was said to have had albumin and casts in the urine. The urinary changes were thought to indicate an acute nephritis secondary to the pneumonia. Since the latter part of August, 1906, he was at his home, but did not gain in strength. He admitted having had a feeling of weight and discomfort in the right side of the abdomen for more than six months, but during his stay in the hospital he did not call the attention of the physicians to it, and was not definitely aware of the presence of a mass. This was suspected a month or so later, and, about the first week in November, after consultation, it was thought to be an inoperable growth involving the large intestine.

When the patient was first seen by Dr. Peck, in consultation with Dr. C. C. Page, on November 13, 1906, the patient was greatly emaciated, and weak and cachectic in appearance. A very large, well-defined mass filled the right side of the abdomen, and could be felt posteriorly. Its surface was smooth, its consistence firm and elastic, and the impulse from the hand in front could readily be felt posteriorly. The tympany of the colon could be traced in front of the mass.

There had been a tendency to constipation, but no obstruction, diarrhœa, or blood in the stools. There had never been any blood in the urine. A moderate elevation of temperature was present, and had persisted for some time. A well-marked valvular heart lesion had been present for a number of years, but compensation was good. There was a marked varicosity of the superficial veins of the right half of the abdomen and the lower thoracic region, which was said to have developed during the attack of femoral phlebitis above referred to. The patient had been failing steadily for several weeks. The tumor had increased in size perceptibly, and he had had a number of "weak spells" or attacks of partial syncope that were quite alarming.

A diagnosis was made of enlarged right kidney, probably a neoplasm, and an exploratory operation was advised. The possibility of a thick-walled hydronephrosis, with a recent low grade of infection, was considered.

Upon the patient's admission to Roosevelt Hospital, on November 16, 1906, his temperature was 101 degrees F.; pulse,

100. An examination of the blood showed 7,800 leucocytes, and 3,400,000 red blood cells; polynuclear cells, 76 per cent.; hæmaglobin, 70 per cent. The urine had a specific gravity of 1028; it was turbid; acid; contained a heavy cloud of albumin; no sugar. Cystoscopy, by Dr. Walter Klotz, with catheterization of the left ureter, showed that the left kidney was functionating well, and that the urine from that side was practically normal. No urine was observed coming from the right ureter, which was not catheterized. An X-ray plate showed no evidence of stone. The shadow in the right kidney region suggested tissue denser than the normal, similar to that seen in old pyonephrosis.

Operation was performed on November 19, 1906, under ether anæsthesia. An oblique incision was made posteriorly over the right kidney, which was later enlarged by the Koenig method. The kidney was much enlarged and tense, with many dilated veins in the fatty capsule. The exploring needle withdrew brownish fluid and particles of necrotic tissue. The anterior and posterior surfaces, at the upper and lower poles, were carefully freed from the surrounding tissues, which were quite adherent to the peritoneum. A large branch of the renal artery which entered the lower pole of the kidney had to be clamped and divided to allow the delivery of the kidney. Isolation of the pedicle was difficult. Heavy chromic gut ligatures were passed on an aneurism needle, and the pedicle transfixed and tied. A heavy clamp was placed distal to the ligatures, and the kidney removed by cutting through its substance near the hilum. Other chromic gut ligatures were placed behind the clamp and tied as it was slowly removed. The stump of the kidney was then trimmed off, two cigarette drains were inserted, and the wound closed in layers with chromic gut, silkworm and silk, excepting at the emergence of the drains. Time of operation, thirty-five minutes.

The kidney was enormously enlarged (Fig. 1). On gross section it was seen to be infiltrated throughout with necrotic-like tumor tissue. On pathological examination by Drs. Hodenpyl and Ditman it was pronounced hydronephroma.

The patient rallied promptly from the operation, and on the second day he secreted 31 ounces of urine. This contained a trace of albumin; no casts. The wound healed per primam. The patient was out of bed twenty days after the operation, and left the hospital on December 21, 1906. His urine on that day was

FIG. 1.—Hypernephroma of right kidney. Dimensions, 15 x 9 x 6 cm.; transverse circumference, 23 cm.; weight, 454 grammes. *A*, outer surface; *B*, cut surface.

acid; specific gravity 1012; it contained a trace of albumin; no casts. Since the operation he had gained in strength, and about 20 pounds in weight. The dilated superficial veins on the abdomen had not diminished in size.

Dr. John Rogers said he was rather surprised that Dr. Peck had been able to shell out such a large renal tumor so easily. The speaker said that some years ago, in dealing with a case of this kind, he had found it necessary to divide the two lower ribs before he was able to deliver the tumor. A free exposure of the parts was also advisable, as it gave a better opportunity to control the free hæmorrhage that was at times encountered.

Dr. Peck said that the curved incision, such as he used in this case, gave a fairly free exposure. In cases where the kidney was adherent at its upper pole it might be necessary to resort to the expedient of dividing the lower ribs, as suggested by Dr. Rogers. In the case he had reported, the hæmorrhage from the perirenal fat was considerable, as the veins were much dilated, but it was controlled without difficulty.

ILEOCOLIC INTUSSUSCEPTION.

Dr. Charles L. Gibson presented a male infant, seven months old, who was admitted to St. Luke's Hospital on December 16, 1906. His family history was negative, and the patient had always been well up to that time.

Five days before admission the mother gave the child a dose of castor oil which was followed by severe cramps, and vomiting at intervals. This condition continued for four days when blood was first noticed in the stools, and there was vomiting of greenish fluid, fæcal in character.

Upon admission, the child's abdomen was much distended and a fluid wave was elicited. A rectal examination was negative. The case was regarded as one of intussusception, and immediate operation advised. Upon opening the abdomen, the intussusception—ileum prolapsed through the valve—was found and easily reduced by manipulation. The child made an uneventful recovery, although for a week the temperature was frequently as high as 106 degrees F.

Dr. Robert H. M. Dawbarn said statistics showed that both this condition and volvulus occasionally recurred, from the cause which originally induced the faulty peristalsis. In order to pre-

vent its recurrence, the speaker said that in two cases that had come under his care he stitched the gut to the adjacent abdominal wall at two or three points, with the idea of a temporary local limitation of peristalsis. As additional preventative measures, he suggested the use of opiates for two or three days after the operation, or after operation, in intussusception, of those two or three drugs that were known to produce reversed peristalsis.

STRICTURE OF THE ŒSOPHAGUS.

DR. GIBSON presented a woman forty-three years old; a native of Russia, who was admitted to St. Luke's Hospital on November 20, 1906. Her family history was negative. She had the usual diseases of childhood. Up to a year ago she had frequent attacks of very severe headache, with vomiting, which lasted for a day or two.

About a year ago the patient vomited a small quantity of bright red blood, and during the next forty-eight hours her stools were black in color. There was no recurrence of this until seven months later, when she vomited a larger quantity of bright blood and had tarry stools for two or three days. At that time she was in St. Luke's Hospital for eight days, but nothing was found to account for her symptoms, and, as she was in fair health, she was discharged. For the past eight months she had had gradually increasing difficulty in swallowing solid food; for three or four months she had been able to take nothing but fluids, and for the last few weeks even these had given her much trouble. On several occasions she had brought up blood, accompanied by the passage of tarry stools. She had never lost large quantities of blood, and her attacks of vomiting had usually occurred shortly after eating. She complained of a feeling of oppression over the lower end of the sternum, but no severe pain. She had a good appetite, but had lost about 25 pounds in weight on account of her inability to swallow food. Her difficulty in swallowing varied considerably: sometimes, for two or three days, she experienced little trouble; then, for a time, she could swallow only a little fluid, and that with difficulty.

Upon admission, the patient was found to be a large, well nourished woman. The heart, lungs and abdominal organs were apparently normal. A No. 24 bougie introduced into the œsophagus met with an obstruction 15 inches from the teeth and smaller

bougies were all arrested at 16 inches. An X-ray picture, taken after the œsophagus was filled with bismuth, showed a funnel-shaped dilatation above a tapering, narrow stenosis of the tube. The obstruction was believed to be due possibly to a tumor of the cardiac orifice of the stomach, and an exploratory gastrostomy was decided on. This operation was done on November 23, 1906. The stomach was normal, and Kader's gastrostomy was done to put the stomach at complete rest. A month later, a string introduced through the mouth was fished out through the gastrostomy opening, the stomach having first been filled up with water, which was then drawn off with an aspirator introduced through the gastric fistula. The stricture was then divided by the string method, until a No. 33 bougie could be passed, not, however, without some difficulty. A moderate amount of bleeding from the mouth followed this procedure.

Following this operation, Dr. Gibson said, the patient was able to take solid food with comparative ease, but since then there had been a gradual recurrence of the stricture. The presumption was that the growth of the œsophagus was a malignant one. The gastrostomy opening is preserved and functionates perfectly without leakage.

OSTEOPLASTIC RESECTION OF THE SKULL FOR INTRACRANIAL HÆMORRHAGE.

Dr. Willy Meyer presented a young man of twenty years, who on June 17, 1906, was thrown from his horse, striking the macadamized road with his right temple. He was immediately unconscious, and was carried home, where he was treated for concussion for forty-eight hours. Then focal symptoms developed, involving the upper left extremity, especially the hand, the left lower extremity, and part of the left facial nerve, the lower eyelid on that side hanging down. His pulse had gradually grown slower, finally reaching 48 per minute, with a temperature of 102 degrees F. There had been no convulsions. He had vomited on the first day after the accident.

When Dr. Meyer first saw the patient, at the beginning of the third day, he was semi-conscious, and protruded his tongue when he was asked to do so. His pupils reacted; the reflexes were slow. There was involuntary urination and defecation. The case was regarded as one of epidural hæmorrhage, due to injury to the middle meningeal artery.

Operation, June 20, 1906. An osteoplastic resection of the right temporal bone was made, as for neuralgia of the fifth nerve. At five places the superficial portion of the bone was chiseled away, and the skull here drilled with Doyen's instrument, and then opened with the Gigli saw, with the assistance of Braatz's instrument. Underneath the skull flap, a large quantity of clotted blood was found, extending upward toward the motor area. This was scooped out. The bleeding proved to be extradural, and the dura was not opened. The osteoplastic flap was thereupon replaced, using the lower trephine openings for the purpose of drainage.

Immediately after the operation the patient's pulse, which had ranged between 48 and 56 per minute, rose to 72. The focal symptoms slowly subsided. The patient's further recovery was uneventful; he left the hospital on the thirteenth day after the operation. To-day he is entirely well and has resumed his horseback riding.

Of special interest in the case seems the rise of temperature on the third day after the injury. A consultant was inclined to attribute the same to a beginning meningitis. In Dr. Dawbarn's case, presented a few months ago, a neurologist explained the like observation, as probably due to an irritation of the heart-centre. Dr. Meyer said he did not share these views, but would explain the fever as the so-called "aseptic," so frequently found in cases of uncomplicated fracture.

Dr. Dawbarn said, apropos of Dr. Meyer's description of his brain operation, in which he alluded to Dr. Dawbarn's recently reported similar cases, that he is about to publish in the Annals of Surgery [this article was printed in the February, 1907, number] an account of several such operation made safer by means of cording the extremities in such a way as to accumulate in them large quantities of blood. In consequence there is, to mention one advantage only, an anæmia of the brain, comparable to that of natural sleep; and at least sometimes it is possible, the patient once chloroformed as usual, to withdraw this drug, and depend for analgesia wholly upon the factor mentioned. Dr. Dawbarn in this article details two instances for example, in which operations three-quarters of an hour long were performed upon dura and brain without suffering, and without awakening until the limbs were uncorded.

INCOMPLETE INTESTINAL OBSTRUCTION: CÆCOSTOMY UNDER COCAINE.

DR. WILLY MEYER presented a man, sixty-two years old, who was admitted to the German Hospital on October 31, 1906. About four months ago he began to feel weak, and lost considerable weight. Three weeks ago he began to suffer from nausea and belching and constipation. There had been no vomiting; the patient had never passed any blood. The abdomen was distended, and the patient complained of some pain on the right side. A careful examination revealed a mass in the left inguinal region. A rectal tube was introduced, which met with an obstruction about 8 inches above the anus. Peristaltic motion was visible through the abdominal wall, and there was a pronounced gurgling sound on auscultation. An examination of the blood showed advanced leukæmia, and the spleen was considerably enlarged.

On November 2, 1906, under local cocaine anæsthesia, the abdomen was opened. The large intestine, much distended, presented. The cæcum was pulled forward and attached to the peritoneum by means of a continuous suture. After carefully protecting the surrounding parts, a very small incision was made into the gut, giving exit to a large quantity of gas and thin, yellow fæcal matter. A good-sized, stout rubber tube, which effectually prevented leakage, was then introduced into the gut, and a permanent cæcostomy wound thus established. To make a water-tight canal according to the Kader-Gibson method seemed contra-indicated in view of the tremendous bowel distention.

The patient made an uneventful recovery from the operation, and his general health had gradually improved. He still wears his tube, which drains, almost water-tight, into a medium-sized glass bottle, which he wears within one leg of his trousers, properly fastened. The stool within the cæcum is kept liquid by daily administration of a small dose of aperient water. There arrive frequent normal defecations per anum. The mass in the left inguinal region has not diminished in size. Patient is opposed to further operating.

The case was apparently one of incomplete intestinal obstruction, due possibly, in view of the result of rectoscopy, to lymphoid infiltration of the walls of the bowel. The patient had never passed any blood or mucus in the stools. The number of leucocytes ranged from 130,000 to 180,000.

Dr. Gibson said that in one case of acute intestinal obstruction of the hepatic flexure resulting from adhesions produced by an empyæma of the gall-bladder, he had resorted to a valvular cæcostomy after the method he has recommended with very satisfactory results. The tube in that case could be readily withdrawn, and it was removed permanently at the end of nine days. The speaker said he had also found this a satisfactory procedure in other cases of intestinal obstruction.

Dr. Meyer said that his reason for making the fistula not water-tight in this case was on account of the enormous distention of the gut. Even with the very small incision that he made into the gut there was a tremendous gush of fæcal matter, which would have rendered the proper protection of the peritoneal cavity difficult had the gut been opened primarily, as is necessary in the Kader-Gibson cæcostomy.

ABDOMINAL SECTION FOR PERICOLONIC PERITONEAL ADHESIONS.

Dr. Willy Meyer presented a man fifty-eight years old who had long suffered from constipation. When he came under observation, on November 17, 1906, he stated that he had lost more than 20 pounds in weight during the past few months, and that since February, 1906, he had suffered from frequent attacks of pain, starting from the middle of the transverse colon and passing down to the sigmoid flexure. He also had occasional attacks of severe cramp-like pain, with rumbling sensations over the entire abdomen. His stools consisted of small, round masses, resembling the fæces of sheep. A rectoscopic examination was negative; also repeated palpation. A blood examination was normal.

An exploratory operation was requested by the patient, and this was done on November 17, 1906. Upon opening the abdomen by means of a small incision, the introduced hand could not feel a tumor anywhere, but upon lengthening the wound for the purpose of inspecting the colon, a number of broad, fan-shaped adhesions were found springing from the parietal peritoneum, surrounding the mesocolon and mesosigmoid, pulling the gut aside, and constricting its calibre. These adhesions were divided between double ligatures until the entire gut was freed. The abdomen was then closed.

The patient had improved greatly since the operation,

although he complained off and on of slight pains in the region of the sigmoid.

THE OPERATIONS FOR NEOPLASMS OF THE TONGUE.

DR. JOHN ROGERS read a paper with the above title, for which see page 553.

DR. F. KAMMERER said he did not quite agree with the reader of the paper as to the advisability of attempting all these operation from the mouth, excepting in those cases where the tumor was still rather small and situated at the border of the tongue. Whether in such cases glands could be felt or not the speaker said he always began the operation with an incision below the inferior maxilla of the affected side, resembling the old Kocher incision for extirpation of the tongue, perhaps supplementing it with a second incision in a downward direction along the anterior border of the sternomastoid muscle. He then extirpated all the glands and the salivary glands in the submaxillary and carotid triangles, and it had been his practice always to ligate the lingual artery. Then it was generally possible to remove the growth with a wedge-shaped excision. The speaker did not think it necessary to remove the entire half of the tongue anterior to the tumor.

Dr. Kammerer said that the moment these malignant growths of the tongue had extended beyond the confines of that organ, one of the bone-cutting operations was indicated. When the disease had invaded the floor of the mouth, he preferred the Langenbeck incision, and in those cases he usually made a bayonet-shaped cut through the bone, which he thought was best suited to hold the bone in place afterwards. When the tumor had invaded the soft palate and perhaps the tonsil, he preferred the Mikulicz procedure of extirpating the ascending ramus of the jaw. In advanced cases, the speaker thought that method gave even a better access to the affected parts than did that of Langenbeck. In both of these operations, it was advisable to tie the external carotid as a preliminary measure.

Dr. Kammerer said that within the past few years, after seeing Kocher do his modification of the Sédillot operation of median section of the lower jaw, he had tried it on a few occasions. Where the tumor was situated near the tip of the tongue, the operation seemed to him certainly a good one, but he had had

difficulty in removing growths by this method that were situated far back in the mouth, and did not consider the method as convenient for these cases as those of Langenbeck and Mikulicz.

The speaker said that in operating on these cases in former years, he had occasionally resorted to a preliminary tracheotomy, and his results, in common with those of other surgeons, were not encouraging. That this procedure increased the danger of pneumonia was generally conceded and the speaker had himself lost two cases of extirpation of the tonsil in former years from this cause.

Dr. Charles L. Gibson said that in cases of advanced epithelioma of the tongue, involving the neck and necessitating some form of division of the bone, he thought the operation was best done in two stages. A preliminary tracheotomy he deemed unnecessary and painful, as the same object could be accomplished by administering the anæsthetic through a tube introduced through the nostril or mouth, and surrounded by packing. With preliminary ligation of the external carotid there was practically no bleeding.

As regarded the choice of operation, the speaker said he thought the Sédillot incision now recommended by Kocher gave the best exposure when the tonsil or pharynx was involved. No matter which method was employed, however, the final results, in his experience, had not been good. In most of the cases upon which he had operated, the disease was far advanced. He could not recall a single instance in which immunity from recurrence had been enjoyed as long as in the case shown this evening by Dr. McWilliams. It was a curious fact, Dr. Gibson said, that patients who were suffering from such a malignant and distressing condition as cancer of the tongue should so frequently allow the condition to progress to an inoperable and hopeless stage.

Dr. Gibson called attention to the fact that the raphé of the tongue practically divided the organ into two separate parts, and he inquired of Dr. Rogers what effect that would have upon the blood supply in attempts to save the tip of the tongue in exsecting the median portion of one-half of the tongue.

Dr. Willy Meyer said that the original Kocher operation, which seemed to have been abandoned, could be improved to a great extent if we divided the anterior belly of the digastric muscle. By the original method, that muscle had usually been preserved.

The speaker said that in a case of carcinoma of the tongue upon which he operated in 1897, where the diagnosis was confirmed by the microscope, he did a preliminary tracheotomy and then followed the Kocher method, thoroughly dividing the anterior belly of the digastric, drawing the tongue forward and extirpating about three-fourths of the organ, and extending the incision as far down as necessary to the hyoid bone. Then the tip of the tongue, which had been preserved, was turned back, and stitched to the remaining part. Of course the lymphatic glands had also been carefully removed. That patient was still alive to-day; he was able to talk well, and had no indications of a recurrence.

Dr. Meyer also referred to a case of sarcoma of the tonsil, which had invaded the pharynx, soft palate and tongue in a young man whom he showed at a meeting of the Surgical Society in 1890. In that case he operated by the Mikulicz method, dividing the floor of the mouth and removing the tonsil, entire tongue and part of the pharynx. In all these extensive bone operations, the speaker said, he regarded ligation of the external carotid as preferable to the lingual.

In regard to the administration of the anæsthetic in these cases, Dr. Meyer said, the introduction of a tube through the mouth or nostril, as mentioned by Dr. Gibson, was an excellent plan in cases where the growth was favorably situated. Where a preliminary tracheotomy was deemed essential, the occurrence of a subsequent pneumonia could possibly be averted by inserting a tracheal tampon cannula, and packing above, leaving the latter in place for forty-eight or fifty-two hours.

The extirpation of the glands was a very essential adjunct to these operations on the tongue, and the speaker said he could recall at least two instances where a recurrence took place in the glands posterior to the sternomastoid, and they had impressed upon him the importance of cleaning out the entire chain of glands, both anterior and posterior, from the sternomastoid to the base of the skull.

In speaking of the after-treatment of the wound following removal of the tongue, Dr. Meyer said he thought it should be left entirely open. He recalled one case where death occurred on the eighth day, due to sepsis, where the internal wound after extirpation of the tongue was closed up to an opening large enough to give exit to the gauze and tampons.

Dr. L. W. Hotchkiss said that in dealing with these cases of epithelioma of the tongue he was glad to hear the emphasis that had been placed by the previous speakers upon the importance of extirpating the glands, because he had been impressed with the relative frequency of recurrence in the posterior chain of cervical glands.

The speaker said that so far as his personal experience with these cases went, he was rather inclined to favor the Whitehead operation through the mouth, with extirpation of the cervical glands as widely as possible on the side of the cancer. In the more extensive cases, with involvement of the tonsil, Dr. Hotchkiss said he had done the operation in two stages, as suggested by Dr. Gibson, first extirpating the glands and tying the external carotid, and at a subsequent period doing a suprahyoid pharyngotomy by the Mikulicz method and completing the operation.

In order to emphasize the importance of extirpation of the glands in practically all cases, Dr. Hotchkiss cited one instance where a small epithelioma of the tip of the tongue in a woman was removed by a V-shaped incision and without gland excision. Within a few months the patient returned with an inoperable involvement of both sides of the neck. He could recall two cases of apparent recovery after operation through the mouth. In one of these cases, two and one-half years had now elapsed without any signs of a recurrence. In this case the cervical glands were also excised. The other case was operated on three and one-half years ago at Bellevue Hospital by the Whitehead method, without preliminary ligation of the external carotid or extirpation of the glands, and in this case three years had elapsed without any evidence of a local recurrence; but the glands of the left side of neck were removed a few months ago and reported epitheliomatous. This patient is in good condition after the secondary operation, and three and one-half years have elapsed since primary operation.

Dr. John B. Walker said his experience coincided with that of the other speakers, that a recurrence in these cases was very apt to occur in the posterior glands. The speaker said that in a case operated on seven years ago, he removed a small epithelioma on the side of the tongue, together with the submaxillary glands, and there had been no recurrence up to the present time.

In connection with the proper feeding of these patients, Dr.

Walker said it was his custom to educate them in the use of the stomach-tube by instructing them to pass it daily for several weeks prior to the operation. Through a small rectal tube and a 3-ounce funnel they were first shown how to introduce water into the stomach, and later milk or gruel, and this knowledge proved of considerable value to them in their proper feeding after the operation.

Dr. Joseph A. Blake said that in three cases of epithelioma of the side of the tongue, with involvement of the floor of the mouth and the jaw, he had removed the mandible, and in that way obtained a beautiful exposure of the parts, enabling him to remove the entire carcinomatous mass, together with the lymphatic nodes. Another advantage of this method was that the wound could be closed more perfectly, the mucous membrane of the cheek being sutured to that of the remaining portion of the tongue. In all the cases in which he had done this operation, which might be considered as an extension of that of division of the jaw, the patients had made a very smooth convalescence. In two of his cases, three years and four years had elapsed without a recurrence. The remaining mandible was held in place for about ten days following the operation by an interdental splint which had been made and fitted prior to the operation.

Dr. Charles H. Peck, in speaking of the liability of involvement of the posterior glands, said that seven months ago he had removed an extensive epithelioma of the tongue, at the same time cleaning out the submaxillary triangle. A local recurrence was confidently expected, but instead of that the patient now had a mass as large as a hen's egg along the posterior border of the sternomastoid muscle.

Dr. Peck said he had had one experience with the Sédillot operation which proved unsatisfactory, as the severed jaw failed to unite, even after wiring and the introduction of an intradental split. The speaker said he had always ligated the linguals in operating on extensive epitheliomas of the tongue, in preference to ligation of the external carotid. The ligation was not difficult, and in one instance he was able to reach the opposite lingual through a curved incision.

Dr. John A. Hartwell said that in one case similar to those referred to by Dr. Blake, the introduction of an intradental plate worked very well. In this case, however, there was an early

recurrence. As a last resort, trypsin, much stronger than the commercial preparation, was used with absolutely no effect.

DR. KAMMERER said he had also seen non-union of the jaw occur after the Sédillot operation in one case, although the bone had been carefully sutured.

DR. GEORGE WOOLSEY said that in his own experience he could not recall a single case of epithelioma of the tongue where the patient survived the three-year period. In nearly all of the cases that had come under his observation, the patients were in a desperate condition, and usually gave a history of having had previous minor operation. The speaker said that he, in common with other surgeons, had to plead guilty to the charge of at times acceding to the urgent request of patients to try conservative measures in the treatment of this condition, which demanded a radical operation because of its extreme liability of recurrence.

In reply to the query raised by Dr. Gibson as to the possibility of necrosis of the tip of the tongue after the ligation of one lingual, Dr. Woolsey said he did not think that was very likely to occur, as there was a good deal of anastomosis between the vessels of the two sides of the tongue—sometimes altogether too much, and he recalled one case where the patient bled to death after the ligation of one lingual. In that case there was an anomalous distribution of the artery. Dr. Woolsey said that in dealing with these cases he had been in the habit of ligating either the lingual or the carotid, and in one desperate case where he extirpated both carotids, he left a small section of the tongue, which subsequently sloughed.

As to the choice of operation, the speaker said that with the exception of the very favorable cases, he had usually resorted to the Kocher method, with median division of the jaw. He had never observed a case where union had failed to occur. He had never resorted to tracheotomy excepting in one case where it became imperative in order to save the patient from dying during the etherization. The speaker said that years ago, while on a visit to Billroth's post-mortem room in Vienna, he saw three cases of epithelioma of the tongue that had died of septicæmia after the operation, and these three deaths had occurred within two weeks.

Dr. Woolsey said he regarded the feeding tube as a very valuable adjunct to the after-treatment of these cases.

DR. ROGERS, in closing, said the more he saw of malignant disease the more he became convinced that certain patients would rapidly succumb to it, no matter what was done for them. The case shown by Dr. McWilliams, where there had been no recurrence after an operation for epithelioma of the tongue four years ago, was certainly an interesting and unusual one. The speaker said he agreed with Dr. Woolsey that necrosis of the tip of the tongue was not apt to occur after ligation of the lingual artery. He recently saw an epileptic who had bitten through the centre of his tongue, dividing both linguals, and the wound was closed by simple stitching without any subsequent trouble.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held January 7, 1907.

The President, JOHN B. ROBERTS, M.D., in the Chair.

FRACTURE DISLOCATION OF THE ATLAS WITHOUT SYMPTOMS OF SPINAL CORD INJURY.

DR. H. AUGUSTUS WILSON exhibited a man, a railroad brakeman, who fell from a train while it was moving at about ten miles an hour, striking upon his left shoulder and cheek. Fearing that he would be run over he forcibly wrenched or twisted his head and shoulders. He did not lose consciousness. During the first two weeks thereafter he did not manifest any symptoms as a result of the fall except some little soreness over his left malar bone and his left shoulder. Two weeks after his accident he began having dull dragging pains about his neck. He continued his occupation as brakeman without interruption for one year. During this year, with the exception of the first two weeks, he was under the care of several physicians for vague symptoms which were considered rheumatic in character and were not ascribed to the fall. At various times during the year, plasters, liniments and ointments were applied to his neck without apparent effect.

During the next year and a half—that is, up to two and a half years after he fell from the train—he worked about three-fourths of the time. During the several periods when he did not work he suffered with pain in his neck, but was otherwise competent to work. Patient said that the jarring and jolting of the train did not increase his pain. Three years after the accident the pain in his neck became more severe and constant, compelling him to

discontinue his work, which he has not resumed up to the present time. The patient states that an abscess of the neck was diagnosticated and an attempt was unsuccessfully made to aspirate it. A few months later he fell into the hands of an osteopath who told him that he had dislocation of the seventh cervical vertebra, and treated him for thirteen weeks. One of the methods resorted to was to suspend the patient so that his feet did not touch the floor; while in this position the head was forcibly rotated. He states that at one of his examinations quick forcible pressure was made upon the top of his head while he was standing. He immediately dropped to the floor and was momentarily unconscious.

In June, 1905, he was brought to the Orthopedic Department of the Jefferson Hospital. A steel brace was applied to remove the weight of the head from the spine and immobilize the neck. This he has worn constantly until the last two months. He has recently taken off the apparatus for an hour at a time every morning and afternoon, without disadvantage. His present condition is that of a well-nourished white man. The mucous membrane of the mouth is of natural color and appearance. No abnormalities of the superficial or deep reflexes. No disturbance of sensation, or other nerve function. Gait is normal. With the stiff supporting brace removed he carries his head in a somewhat stiff, unnatural manner.

Special Senses.—Eye examination by Dr. Wm. M. Sweet. Pupillary reflexes. Media clear, optic discs clearly outlined, and retinal vessels of normal calibre and direction. No defect of ocular rotations. Other fields of vision show no contraction.

Throat examination by Dr. J. L. Harkness, finds he has a subacute rhinitis, intumescent turbinates, relaxed and injected soft palate, and the pharynx bulges forward below the line of the uvula, apparently narrowing the œsophageal and laryngeal openings. Otherwise the pharyngeal conditions appear normal.

Physical Examination of the Neck.—Inspection from a directly posterior standpoint does not reveal any manifest irregularity. On view laterally, the patient's head is observed to be inclined forward and with the chin elevated apparently in the same position in which it was held by the brace. Surface at the back of the neck is observed to have its concavity posteriorly and an elevation above and below. The Adam's apple is not unduly conspicuous.

Palpation of the tumefaction above referred to shows that it is hard and immovable, not painful on pressure. Pressure in the depression just below the occiput elicits pain, but not of a severe type. The guarded manner in which the head is constantly held renders it difficult to determine the amount of motion at or above the seat of the injury. Definite knowledge as to the mobility of the upper spine was not considered of great importance. The risk of subjecting the patient to the accompanying trauma rendered it inexpedient to determine the extent of mobility.

The X-ray plate (Fig. 1) shows a fracture of the odontoid process and a forward dislocation of the atlas, which occupies a tilted position. Until recently the patient was unable to sleep in recumbency, but could do so sitting on a chair with his head forward on a pillow. Occasionally he has difficulty in swallowing because of the mechanical displacement of the œsophagus.

Dr. James K. Young said he had seen a similar case in a child who fell and dislocated the second cervical vertebra. With the injury there was loss of power and sensation in the lower extremities. The remarkable feature in Dr. Wilson's case is the absence of cord symptoms. From the history of the case he would consider it one of spondylitis following injury, this injury possibly being dislocation and spontaneous reduction; now there is dislocation as a result of the spondylitis.

Dr. George G. Ross mentioned a case of fracture of the bodies of the tenth and eleventh dorsal vertebræ and bowing of the spinal column without paralysis. The accident occurred in July; the patient when on a hay wagon catching his head and bending over, compressing the bodies of the vertebræ and springing apart the spinous processes. This formed a distinct ridge over which ran the cord, but there was neither permanent motor nor sensory symptoms. The diagnosis was confirmed by the X-ray.

Dr. Gwilym G. Davis said that recovery from injuries of the vertebræ in the cervical region are more frequent than is generally supposed. He has seen several cases end in recovery even though deformity was marked.

Dr. Wilson, in closing, said the man was very clear in his description of the accident and stated that the symptoms were not such as to demand the care of a physician until after two weeks. The railroad physicians in the relief bureau did not consider the case worthy of attention, hence the symptoms must have

FIG. 1.—Fracture dislocation of the atlas.

been very trivial. He believes the great deformity followed the "osteopathic treatment." The symptoms were so aggravated by it that the man could not lie down, being obliged to sit with his head forward. During part of the time he walked the street night after night. There probably was some displacement originally, but that method of treatment increased it.

TENDON TRANSPLANTATION.

DR. HENRY R. WHARTON exhibited a child aged twelve years, who, when three years of age, had sustained a fall, injuring the spine. Paralysis of the entire left side followed, and the patient was confined to bed for three months. The arm gradually improved, and the function was restored to normal. The leg improved, but with a persistence of muscular atrophy, and an equinus valgum. At the Presbyterian Hospital, in July, 1906, Dr. Wharton had performed the following operation:

The tendo Achillis and peroneus longus and brevis tendons were divided subcutaneously and the tendon or the tibialis anticus was exposed and divided. The tendon of the extensor longus digitorum was next exposed and divided and the proximal end of this tendon was sutured to the distal end of the tendon of the tibialis anticus. To overcome the dropping of the great toe the tendon of the extensor propius pollicus was exposed and divided, and after exposing the tendon of the peroneus tendon it was divided and sutured to the distal end of the tendon of the extensor proprius pollicis. The wounds were closed and the limb put in a position of over-correction in a plaster of Paris bandage. Later, a brace was fitted and the patient was allowed to walk upon the limb.

DR. JOHN H. JOPSON, who assisted Dr. Wharton at the operation, said the patient showed extraordinary improvement, the foot previously being a useless member. He now resorts to this type of operation with a great deal of confidence. The main element of success is the selection of cases. In those with good muscles to utilize for transplantation, the results will be good. If complete paralysis be present, operation will result only in disappointment; those cases should be let alone, so far as transplantation operations are concerned.

RECOVERY FROM SELF-INFLICTED COMPLETE SUBHYOID LARYNGOPHARYNGOTOMY.

DR. JOHN H. JOPSON and DR. GEORGE C. STOUT showed a patient recovered from self-inflicted complete subhyoid laryngopharyngotomy. He was an adult aged forty-seven, admitted to the Presbyterian Hospital three months previously, suffering from shock and loss of blood. Two hours before he had cut his throat, and the wound extended from one sternomastoid muscle to the other, dividing the skin, the subcutaneous and the muscular tissue of the thyro-hyoid space, the pharynx being opened to the full extent of the wound. The epiglottis was cleanly severed at its attachment to the thyroid cartilage, drawn upward and turned backward out of sight. A small piece of the upper border of the thyroid cartilage was sliced off on either side. The false cords were not injured, the weapon having passed just above them. After reaction, which quickly followed, the patient was etherized through the wound in the neck. The epiglottis was drawn downward and forward and sutured to its place of former attachment by three sutures of No. 1 chromicized catgut passed through its entire thickness and through the thyroid cartilage, which was partly ossified. One suture passed through the median line and one was placed on either side. These sutures held the epiglottis in excellent position, and were reinforced by sutures passing through the superficial structures and perichordium. The lateral angles of the wound in the pharynx were then tightly closed by chromicized suture and the entire wound closed by deep and superficial stitches. Following operation, the patient did very well. There was considerable laryngeal irritation for some days, shown by cough and free expectoration of mucus and suppression of voice. The temperature was slightly elevated for ten days. There was a slight superficial suppuration at a couple of points. At no time were there evidences of œdema or respiratory obstruction. Inhalations of benzoin vapor were instituted. There was a gradual restoration of voice after ten days. Twenty-four days after operation it was noted that laryngoscopic examination showed the epiglottis to be in good position as far as its attachment was concerned, and leaning backward somewhat more than normal. The voice was then quite strong and is now normal. Recovery is now complete.

DR. ASTLEY P. C. ASHHURST said that he desired in this

connection to report a case of self-inflicted suprahyoidean pharyngotomy, with fatal result, because it did not seem fair to let it pass unrecorded when the successful case of Drs. Jopson and Stout was being published. On January 5, 1906, Dr. Ashhurst was called to the Orthopædic Hospital to see a nervous patient who had suddenly gone insane and had produced a large wound in his neck by sawing it with a broken bottle which he had prepared on purpose. Before Dr. Ashhurst reached him, the patient had been given morphin and an intravenous injection of saline solution; and to this treatment it was probably due that he had not died at once. The trachea and larynx were found wagging back and forth in the wound, the patient being speechless, nearly apnœic, and almost exsanguinated. High tracheotomy was immediately performed, and respiration being thus somewhat restored, the wound was examined. It extended from one angle of the jaw to the other, grazing the anterior surface of the larynx, passing between the hyoid bone and the jaw, and opening the pharynx widely between the epiglottis and the base of the tongue. Seven or eight bleeding points were ligated, including the right lingual artery. A nick in the right internal jugular vein was sutured. The right hypoglossal nerve was divided just below the mylohyoid muscle; but as its cranial end could not be found winding around the origin of the occipital artery, search for it was finally abandoned. The base of the tongue was then sutured to the muscular wall of the pharynx with mattress sutures of chromic gut; the depressor muscles of the jaw were sutured to those of the floor of the mouth, and the skin was closed, with drainage from each angle. The next day the temperature was 103 degrees F., and the following day 105 degrees F. By the third day it had fallen to 101 degrees F., and there appeared some hope of recovery. After consultation with Dr. W. J. Taylor and Dr. Morris Lewis, the tracheotomy tube was removed, and the patient in reply to a query said he felt "as fine as silk." He breathed fairly well through the larynx for about fifteen minutes, then became cyanosed and had an attack of coughing. Although the tube was at once replaced, voluntary respiration was not restored. Artificial respiration, and mouth-to-tube insufflation were practised, but fifteen minutes after the heart had ceased to beat the patient was abandoned as dead. This was seventy hours after the operation.

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CERVICAL RIB.

Dr. Joseph M. Spellissy exhibted a seventh right cervical rib, with photographs and skiagraphs of the anomaly before its excision, and presented the patient, a girl of twenty years, from whom it had been removed. An accident, a year before the patient applied for advice at the Orthopædic Department of the University Hospital in the service of Dr. DeForest Willard, was followed by deformity of the right shoulder. Examination not only discovered a sternal luxation of the right clavicle, but the presence of a right seventh cervical rib. An X-ray plate made by Dr. William R. Pancoast confirmed the diagnosis. The rib was excised, but not without difficult dissection. The subclavian artery passed over the middle of the cervical rib, resting in a deep groove. The distal end of the cervical rib articulated with the upper surface of the first dorsal rib. This articulation was disarticulated. The artery was dissected free some 2 to 3 inches and looped over the distal end of the cervical rib as an umbilical cord is slipped over a fœtal head. The distal end of the cervical rib was now raised above the artery, freed from attachments, and disarticulated from the seventh cervical vertebra. The subclavian vein was not seen, and no abnormality was noted in the circulation of the right arm.

The specimen was pronounced the most perfect in the experience of Dr. W. W. Keen and of Dr. W. R. Pancoast.

PYRALIN AS A COVERING FOR METAL BRACES.

The use of pyralin dissolved in acetone and painted on stockinette as a fixed dressing by J. K. Young, suggested some years ago to Dr. Spellissy its probable suitability as a covering for metal braces. Its experimental use by Dr. Spellissy had verified his anticipations. He exhibited a spine brace so covered, that had been to Brazil and had required no recoating except where alterations obliged by the growth of the patient necessitated it. The pyralin is applied like paint, with a brush—or preferably by dipping—and in successive coats.

The finish is improved by the rubbing down of each coat with sandpaper and later with pumice stone.

CIRCUMCISION.—A PLASTIC IN CONSTRICTED PREPUCES.

Dr. Oscar H. Allis demonstrated the technic of an operation devised by him, and read a paper descriptive of it, for which see page 610.

REMOVAL OF A KNITTING-NEEDLE FROM AN ABDOMINAL ABSCESS.

Dr. W. E. Lee reported the following case: An unmarried woman, twenty-four years of age, was admitted to the Pennsylvania Hospital December 28, 1906, with the diagnosis of iliac abscess. She gave a history of an indefinite illness of six weeks' duration, and it was not until after the operation that the true history was obtained. In June, 1905, she had reason for suspecting herself pregnant and applied to an old woman for help. With the patient standing, the right knee flexed and the foot resting upon the seat of a chair, and without raising her clothes, this woman took a bone knitting-needle from a nearby table and introduced it into the vagina with the right hand. This was followed by profuse bleeding which continued for several days. There was the normal flow at the next menstrual period, which has recurred regularly ever since. Several weeks after the operation the patient noticed a definite spot of tenderness in the right side close to the pelvic bone, which prevented the wearing of corsets; aside from this she has suffered no inconvenience from the operation.

On admission, her temperature was 99.2 degrees F., pulse 100 and respirations 24. There was a distinct bulging of the abdominal wall in the lower right quadrant, caused by a firm, tense, intra-abdominal mass and a superficial fluctuating tumor about the size of half a walnut, ½ inch above and ½ inch to the median side of the anterior superior spine of the ilium. This mass was first noticed three days before her admission to the hospital.

General anæsthesia was induced with ethyl chloride and the superficial fluctuating tumor opened, evacuating a few drops of pus. At the bottom of this abscess cavity a hard, sharp substance was found; this proved to be a piece of the bone knitting-needle, 4½ inches in length. The needle came from a small sinus leading down into the pelvis.

A vaginal examination, made three days after the operation, showed a small uterus in the mid position, with the cervix pointing toward the right vaginal wall and the fundus pushed far over to the left side of the pelvis. There were no abnormal openings or scars in the vaginal walls and the cervix was normal except for a thin opaque discharge which escaped through the cervical canal.

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